A REVISION OF THE NEW WORLD MEALYBUGS OF THE GENUS RHIZOECUS

(HOMOPTERA: PSEUDOCOCCIDAE)

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By EDSON J. HAMBLETON, *cooperating scientist, Systematic Entomology Laboratory, Northeastern Region, Agricultural Research Service*

Rhizoecus Künckel d'Herculais is a cosmopolitan genus occurring most commonly in tropical, subtropical, and warm temperate areas. Distribution records for the Americas indicate the presence of the *Rhizoecus* species from southern Canada southward into the West Indies and South America. By far the largest number of species is reported from Mexico, California, and Florida, where extensive collecting has been done in recent years. Elsewhere in the United States no more than 5 species are known to occur in any of 20 additional States.

This study began when I was attempting to make a key to the *Rhizoecus* species of Florida. As a result of this study it was apparent that a reexamination of all North American species would be desirable. Because of a considerable amount of undescribed material, it was thought that a revision of the genus for the Western Hemisphere would be useful.

Descriptions and illustrations have been prepared for 52 species, of which 12 are described as new. Certain morphological characters generally omitted by workers greatly facilitate the separation of species and are included here. This bulletin gives a key to the American species of *Rhizoecus* and records their host plants and distribution. The study is based entirely on adult females.

In the illustrations certain body structures are portrayed in detail. The dorsal and ventral halves of the body are not shown, because large outline illustrations of *Rhizoecus* lack sufficient detail to be practical in identifying species.

All illustrations were prepared with the use of an ocular grid and squared paper. The antennal segments, anal ring, and claws are of approximately the same magnification for all species, each about × 1,200; the cephalic plate and rostrum, each about × 600; the circuli, cerores, eyes, tubular ducts, and other structures are not always drawn to scale.

Types are located in collections of the following institutions hereafter abbreviated as shown: British Museum (Natural History), London (BM); California Academy of Sciences, Stanford (CAS); California State Department of Agriculture, Sacramento (CDA); Florida State Collection of Arthropods, Gainesville (FSCA); Instituto de Biologia, Ciudad Universitaria, Mexico (IBM); University of California at Davis (UCD); University of Georgia, Experiment (UG); National Collection of Coccoidea, U.S. National Museum, Washington, D.C. (USNM); and Virginia Polytechnic Institute, Blacksburg (VPI).

ECONOMIC IMPORTANCE

Mealybugs have long been important as pests of farm crops and greenhouse, nursery, and ornamental plants. Their destructive role in American agriculture, particularly in California, has been well summarized by McKenzie (*1967*).[1]

[1] The year in italic after an author's name indicates the reference in Literature Cited, p. 54.

The soil-inhabiting mealybugs that feed on the roots of plants, although less well known than those feeding above ground, damage a wide variety of commercially grown, subtropical, ornamental plants. Consequently, much effort has been made in California and Florida to determine the presence of subterranean mealybugs, their host plants, and the extent of injury they cause. Several species belong to the genus *Rhizoecus*. In the United States, four of the six most injurious species of *Rhizoecus* are of foreign origin. They are *falcifer* Künckel d'Herculais, *kondonis* Kuwana, *americanus* (Hambleton), and *simplex* (Hambleton). The remaining two, *floridanus* Hambleton and *pritchardi* McKenzie, are considered endemic to Florida and California, respectively.

Of the 15 species now recognized in California, *falcifer* and *kondonis* are the best known. The former is a widely distributed pest capable of inflicting serious damage to many kinds of garden, nursery, and greenhouse plants. Its distribution in the United States is probably more widespread than records indicate. *R. kondonis* also has demonstrated its potential as a pest of alfalfa, strawberries, and prunes in California, the only State in which it has been recorded.

The three most important species of *Rhizoecus* in Florida are *americanus, floridanus,* and *simplex,* all widely distributed and economically important on a variety of nursery and greenhouse ornamentals. *R. pritchardi,* originally known only from California, is present in Florida, in five additional States, and in Canada. It is chiefly a greenhouse pest causing serious injury to African violets.

One of the important factors affecting coffee production in several countries of Central America and South America is directly related to the feeding of *Rhizoecus* and related mealybugs. Several species also have been reported attacking other important crops, such as cacao, citrus, cotton, and bananas.

Problems on the biology and control of mealybugs are complex and warrant further investigation. Although some control of *Rhizoecus* species has resulted from applying insecticides in sprays or drenching, the nature of the mealybug habitat and lack of pertinent data on their bionomics undoubtedly have limited progress in developing effective control procedures.

HISTORY

Cockerell (*1894*) described the first United States hypogeic mealybug of the tribe Rhizoecini and named it *Ripersia maritima.* J. D. Tinsley (in Cockerell, *1899*) transferred this species to *Ripersiella* Tinsley, and Cockerell (*1901*) described a second species, *Ripersiella leucosoma.* For the next 45 years no additional Rhizoecini taxa were reported in North America except two introduced species, *Rhizoecus falcifer* Künckel d'Herculais from Europe and *R. kondonis* Kuwana from Japan. I (*1946a*) published the first comprehensive paper on mealybugs of the *Rhizoecus* complex of genera. This article treated 22 New World species and 12 from Africa, Asia, and Europe that were included in 3 genera, *Coccidella* Hambleton, *Ripersiella,* and *Rhizoecus.* Ferris (*1953*) synonymized *Coccidella* with *Rhizoecus,* transferred 12 North American species from *Coccidella* and *Ripersiella* to *Rhizoecus,* and described 2 new species from California. McKenzie (*1960–67*) in a series of papers synonymized one of Ferris' species, and he described 13 new species from Arizona, California, and Mexico, 3 of which are here considered synonyms. Miller and McKenzie (*1971*) added a single new species from Mexico. Hambleton (*1973*) described a new species from Florida and Georgia, transferred two species from *Ripersiella* to *Rhizoecus,* and (*1974*) synonymized *Ripersiella* with *Rhizoecus.*

HOST PLANT RELATIONSHIPS

The American species of *Rhizoecus* display remarkable diversity in host plant selection. They are reported here from 62 plant families. Records indicate a single host for a few species, but most injurious species, such as *americanus, floridanus,* and *simplex,* are

polyphagous. Food plant and distribution information on pest species has been greatly expanded owing to their frequent collection in nurseries and greenhouses. One can assume that nursery and greenhouse conditions favor the survival of *Rhizoecus* species on many unrelated plants. A similar pattern is indicated in open country in Virginia, where I have collected *distinctus* (Hambleton) on the roots of 10 different plants representing 6 families within a radius of 50 yards. Host acceptance by *falcifer* and *kondonis* in California is similar in diversity to that exhibited by the species just mentioned. The family Gramineae, with 19 *Rhizoecus* species, is the most commonly infested host family. A few other acceptable families of economic importance include the Gesneriaceae, Leguminoseae, Rosaceae, Rubiaceae, Rutaceae, and Sterculiaceae.

Our limited knowledge of this secluded group of subterranean mealybugs is ample proof of their ability to adapt to varied ecological conditions. Species showing no particular host preference would seem to indicate that the most critical limiting factors in their establishment would be environmental and not host selectivity. Successful dissemination resulting from the movement of living plant material, soil, and plant debris doubtless will lead to a more widespread distribution of these insects.

TERMINOLOGY AND DISTINGUISHING CHARACTERS

Most of the terminology in this bulletin is the same as in my (*1946a*) previous publication and some conforms to common usage. For clarity and uniformity, it is hoped that other workers will adopt the terminology used here. Improper use of the terms "pore" and "duct" should be corrected. Dimensions of the body are given in millimeters. All other measurements are in microns.

Body Shape and Size.—Most adult females of *Rhizoecus* are elongate oval, though some are broad and others are narrow. Older specimens tend to become more rotund, whereas newly mature adults have not become distended and appear small when mounted. In the descriptions here the maximum and minimum lengths and widths of a species represent the ranges for the specimens at hand. Wide variation in dimensions may exist within a species between young adult females and fully mature ones with distended bodies.

Antennae.—Considerable variation exists in the size and shape of the five- or six-segmented geniculate antennae and in the individual segments. Differences in the antennae can often be used to characterize species. In the shorter type most segments are wider than long in contrast to the reverse condition in the longer type. Antennal measurements were made along the longer margin of each segment and the divisions number I to VI.

The antennae are clothed with numerous elongate setae. Also present are enlarged sensory setae whose size and shape are excellent characters for differentiating species. All five-segmented antennae have five sensory setae on segment V, one elongate, spinelike sensory seta, and four falcate sensory setae; the smallest one is borne proximally. In the six-segmented antennae the terminal segment has one spinelike sensory seta and three larger falcate sensory setae; a smaller fifth sensory seta is borne distally near the margin on segment V. The larger falcate setae may be long and slender, short and stout, tapered or clavate, and the other setae display similar differences in shape.

The interantennal space varies considerably and generally is not a satisfactory character for differentiating species.

Eyes.—The presence or absence of eyes is an important specific character. When present, these simple structures may be obscured by the antennae or hidden between folds of the integument, or they may be difficult to observe because of their small size and weak pigmentation. The eyes vary greatly in size and shape. They are weakly protuberant to comparatively prominent and hemispherical to globular. Most eyes are round or slightly oval, but some are much longer than wide.

Rostrum.—Only the two distal segments of this conical structure are referred to in the

text. The location of its 20 setae occupy about the same position in each species. Measurements of the length and width of the rostrum and the length of its loop are useful diagnostic characters. Its size and shape are fairly constant within a species. The extension of the rostral loop may be short, or it may reach to or slightly beyond the attachment of the second pair of legs. However, in newly matured females the rostrum is more robust and rounded, and the loop appears to be longer than in older adult females.

Cephalic Plate.—This is an irregularly shaped, sclerotized plate situated on the medioventral surface of the head anterior to the mouth parts. It is taxonomically useful. The plate sometimes has small vacuoles near its center and normally possesses several body setae on its periphery. It is present in most species. Intraspecific and interspecific variation occurs in the structure and the degree of sclerotization of this plate. Differences in staining techniques or condition of specimens may render the plate difficult to observe.

Dorsal Ostioles.—These structures are not too helpful in separating species, and their presence sometimes is questionable. They may be heavily sclerotized, conspicuous, and surrounded by numerous pores and body setae or weakly sclerotized and with very thin rims.

Legs.—The size, shape, and nature of the claws and claw digitules are the most useful leg characters for separating the *Rhizoecus* species. The claws vary greatly in size and shape. The claw digitules are either long or short. The long ones extend to or slightly beyond the claws and usually are dilated apically; the short ones vary in length and thickness but seldom reach beyond the midlength of the claws. Leg spines have proven of slight value in separating species, and they are omitted from descriptions.

Circulus.—The size, shape, and structure variation of the circuli are reliable differentiating characters in over 50 percent of the species. Normally only a single circulus is present midventrally on the fourth abdominal segment, but an additional smaller circulus occasionally is found on the third abdominal segment; specimens of a few species seem to have two circuli consistently. In some species, however, the number of these structures is variable. In *R. campestris* Hambleton three to six circuli have been observed on the second to seventh abdominal segments. The circuli display much variation in size, shape, and structure. They may be conical, truncate, or depressed with narrow or widely sclerotized rims, and the distal surface may be reticulate, faveolate, or undifferentiated.

Anal Lobes.—The anal lobes may be well developed, slightly protuberant, or absent. A group of three or more elongate setae, several auxiliary setae, and trilocular pores laterad of the anal ring near the body margin define each lobe area. This area, or the lobe itself, may be sclerotized. Individuals may appear to lack sclerotization, even when present, owing to unsatisfactory mounting procedures. The size and length of the anal-lobe setae compared to those of the anal-ring setae are good characters for assisting in species separation. The number of elongate lobe setae is also useful.

Anal Ring.—The cellular structure of the anal ring is invaluable in separating species, though heretofore little emphasis has been placed on this structure. The nature and disposition of the cells—their size, form, number, and arrangement—vary little within a species. In some species the cells of the outer part of the ring possess spicules, either one to a cell as in *falcifer,* or three to five as in *distinctus.* The cells of the inner part of the ring are usually larger and more irregular in outline than the outer ones. Also characteristic of the genus is the innermost circle of hemispherical cells that make up part of the darkened area. The comparative differences in length and thickness of the anal-ring setae with those of the anal-lobe setae are often helpful in species diagnosis.

Cerores.—The cerores are of maximum value in distinguishing species. They are the most conspicuous wax-secreting structures in the Rhizoecini and differ from the multilocular disk pores, the triangular and the medioventral pores. Morphologically the ceroris is not a pore because it is composed of either two or three ducts. The true pore in the Rhizoecini

generally consists of three or more loculi and does not possess visible ducts.

Bitubular or tritubular cerores are among the more important structures that characterize *Rhizoecus*. Their size, shape, and distribution are excellent characters for distinguishing species. The bitubular ceroris occurs in only 10 of the 52 species in the Western Hemisphere. De Lotto (*1957*) and McKenzie (*1967*) used the term "unitubular pore" for what is actually a bitubular ceroris in *geniculatus* James from Kenya and *disjunctus* McKenzie from California. The elongate ducts in the bitubular cerores of these species appear to be fused. The bitubular cerores may appear as elongate objects resembling spicules with about one-half of their individual ducts projecting above the derm as in *disjunctus*, or elongate and stout with wide ducts weakly protruding above the derm as in *mexicanus* (Hambleton) and *solani* (Hambleton), and with small, elongate, strongly protruding ducts as in *kondonis* and *menkei* McKenzie.

In the tritubular cerores the three ducts are placed together in a whorl with their distal extremities divaricated. These cerores may vary in size and shape interspecifically and intraspecifically. The walls of their individual ducts may be nearly parallel or taper gradually toward their apices. Several species have two or three sizes of tritubular cerores—large, medium, and small. Where more than one size is present, the smaller one usually is confined to the venter and the larger to the dorsum. In *ornatus* (Hambleton) the larger cerores have short, stout ducts, which are barely longer than wide.

The cerores occur dorsally and ventrally on all areas of the body, but are more numerous on the abdomen.

Multilocular Disk Pores.—The disk pores are circular and possess 5 to 12 loculi. They are important taxonomic characters. These pores are present in most species and normally occur on the venter in the area of the vulva. When they are abundant, they may be restricted to the venter, or they may be widely distributed over the derm.

Tubular Ducts.—The size, number, and distribution of these ducts are important aids in separating species. These structures when viewed from above appear as circular objects on the derm. In profile they are readily discernible and should not be mistaken for pores. Tubular ducts vary in size. They are narrow and elongate or short and stout, and they may be heavily sclerotized. No distinction is made between the oral-rim and oral-collar tubular ducts because the thickness of their rims varies considerably. Most species, however, appear to have the oral-rim type of duct. In some species the tubular ducts are common and widely distributed, in others they are scarce or absent.

Mushroom Bodies.—Under high magnification these mushroom-shaped structures resemble tubular ducts, but their exact nature has not been determined. In slide mounted specimens they assume various positions, some of which are shown in figure 32. They measure less than one-half the diameter of a trilocular pore.

Trilocular Pores.—These pores are present in all species of *Rhizoecus* and are among the smallest and most common pores in the genus. Their relative abundance is of some taxonomic significance. The trilocular pore is subtriangular to circular and varies in size, each having three loculi. These pores occur over the entire derm.

Medioventral Pores.—These pores are larger and more elongate than the trilocular pores. They appear conical and vary considerably in size. They occur in clusters of 4 to 23, each near the medioventral line of the sixth and seventh abdominal segments. Three species are known to possess these pores.

Circular Pores.—Appearing as small circles without depth, these pores are approximately one-half the diameter of a trilocular pore. They occur dorsally on the midabdominal segments in only three species—*pritchardi*, *subcuperalis* Hambleton, and *pauciporus* Hambleton.

Body Setae.—In most species of *Rhizoecus* the body setae are rather uniformly distributed, but they may be most abundant dorsally on the head and along the body margins. They are usually short and slender but may vary in length and thickness. In a few species the setae are good differentiating characters.

GENUS RHIZOECUS KÜNCKEL D'HERCULAIS

Rhizoecus Künckel d'Herculais, 1878: 163; Hambleton, 1946a: 50; Ferris, 1953: 426; Williams, 1962: 41; De Lotto, 1964: 381; McKenzie, 1967: 370; Hambleton, 1973: 63; 1974: 147.
Morrisonella Hambleton, 1946a: 16.
Coccidella Hambleton, 1946b; 177.
Ripersiella Tinsley, in Cockerell, 1899: 278; Cockerell, 1901: 165; Morrison and Morrison, 1922: 54; Hambleton, 1946a: 59; De Lotto, 1964: 382; Williams and de Boer, 1973: 241; Hambleton, 1974: 147. Type-species: *Rhizoecus falcifer* Künckel d'Herculais.

I share Ferris' view on the generic structure of *Rhizoecus,* but I am of the opinion that the status of the genus can be strengthened by increased knowledge of characters that have not been adequately utilized in the past. Of major importance are the bitubular and tritubular cerores, the cellular structure of the anal ring, and the sensory setae of the antennae. Also, the circuli, the claws, and tubular ducts will provide additional means of characterizing the genus and will assist in the recognition of its species.

The composition of *Rhizoecus* is here considered identical to my (*1973*) characterization. An effort was made to weigh the value of morphological details of all taxa in arriving at a practical and useful classification.

Approximately 85 percent of the described world Rhizoecini species are placed in *Rhizoecus*. The remaining 7 genera, of which 4 are monotypic, include 17 species. Although our present knowledge of the tribe is inadequate and further change in its status is inevitable, it is hoped that a better understanding of its known genera will be forthcoming.

The genus may be characterized as follows: Antennae five- or six-segmented, geniculate, sensory setae of terminal segments well developed. Anal ring usually distinct, with six setae, its cellular structure diverse. Anal-lobe area usually undeveloped, with or without sclerotization and with three or more elongate setae. Derm with bitubular or tritubular cerores of one or more sizes, with trilocular pores, with or without multilocular disk pores and tubular ducts. Circuli numbering from none to six, of variable size and shape. Head often with an irregularly shaped ventral cephalic plate anterior to the mouth parts. Eyes present or absent, varying in size and shape. Legs generally spinose, claws of varying lengths, digitules short and setose, or elongate, extending beyond tip of claws and dilated apically. Body setae of variable lengths, mostly short. Dorsal ostioles usually distinct, strongly sclerotized, or inconspicuous and possibly absent. Body shape oval elongate to broadly ovate.

KEY TO THE NEW WORLD SPECIES OF RHIZOECUS

1.	Multilocular disk pores present	2
	Multilocular disk pores absent	34
2.	Circuli present	3
	Circuli absent	13
3.	Tritubular cerores present	4
	Bitubular cerores present	5
4.	Antennae five-segmented	*californicus* Ferris
	Antennae six-segmented	*sonomae* McKenzie
5.	Antennae five-segmented	6
	Antennae six-segmented	7
6.	With two circuli; anal lobes rounded, protruding, each with 8 to 10 elongate setae; tubular ducts of normal size; body setae conspicuous	*kondonis* Kuwana
	With three to six circuli; anal lobes not as above, each with three to four elongate setae and several shorter body setae; tubular ducts stout, larger than trilocular pores; body setae inconspicuous	*campestris* Hambleton
7.	Digitules short, setose, not extending beyond middle of claws	*menkei* McKenzie
	Digitules long, slender, extending to tip of claws	8
8.	Eyes absent; normally with two circuli, but occasionally with one	*bituberculatus* McKenzie
	Eyes present; normally with one circulus	9

9. Bitubular cerores with their ducts appearing to be fused, projecting at least 5μ–6μ above derm ..... *disjunctus* McKenzie
   Bitubular cerores with their ducts separated, projecting less than 5μ above derm 10
10. Circulus large, about same width as anal ring; multilocular disk pores occasionally present on head; rostral loop reaching to or slightly beyond insertion of second pair of legs ..... *mexicanus* (Hambleton)
    Circulus small, about one-half width of anal ring; multilocular disk pores confined to abdomen; rostral loop not reaching insertion of second pair of legs 11
11. Anal lobes unsclerotized; legs rather large, stout, about 290μ long; cephalic plate weakly indicated ..... *solani* (Hambleton)
    Anal lobes sclerotized; legs moderately small, short, less than 250μ long; cephalic plate strongly indicated 12
12. Falcate sensory setae rather stout, weakly clavate, claw digitules apparently not dilated apically ..... *totonicapanus* (Hambleton)
    Falcate sensory setae more slender, tapering; claw digitules dilated apically ..... *gracilis* McKenzie
13. Antennae five-segmented; eyes absent 14
    Antennae six-segmented; eyes present 15
14. Anal lobes unsclerotized, each with five to seven elongate setae; cerores predominately large; body setae mostly long; multilocular disk pores numerous in vulvar area ..... *falcifer* Künckel d'Herculais
    Anal lobes sclerotized, each with three elongate setae and several shorter body setae; cerores predominately small; body setae short, rather sparse; multilocular disk pores scattered in vulvar area ..... *nitidalis* Hambleton
15. Bitubular cerores present ..... *boharti* McKenzie
    Tritubular cerores present 16
16. Tritubular cerores of large size only 17
    Tritubular cerores of two or three sizes 20
17. Multilocular disk pores scarce, restricted to vulvar area; tubular ducts present ..... *subcyperalis*, new species
    Multilocular disk pores relatively abundant, widely distributed dorsally and ventrally; tubular ducts absent 18
18. With 21–25 tritubular cerores; anal-ring setae, stout, acute, averaging about 35μ long; length of longest anal-lobe seta about equal to width of anal ring; multilocular disk pores mostly with 7 loculi ..... *spinipes* (Hambleton)
    With 46–74 tritubular cerores; anal-ring setae slender, averaging about 60μ long; length of longest lobe seta considerably greater than width of anal ring; multilocular disk pores mostly with 10 loculi 19
19. Anal lobes protruding, each with four or five elongate setae and three or four shorter auxiliary setae; multilocular disk pores absent from head ..... *associatus* (Hambleton)
    Anal lobes seldom showing any protrusion, each with three elongate setae and three smaller auxiliary setae; multilocular disk pores occasionally present on head ..... *distinctus* (Hambleton)
20. Tritubular cerores of three sizes 21
    Tritubular cerores of two sizes 22
21. Tubular ducts present; anal lobes usually distinctly sclerotized; 10–12 small tritubular cerores present ventrally on abdominal segments V–VIII; legs about 366μ long, stout ..... *americanus* (Hambleton)
    Tubular ducts absent; anal lobes weakly sclerotized; 11–36 small tritubular cerores present ventrally on abdominal segments IV–VIII; legs about 315μ long, of medium size ..... *mayanus* (Hambleton)
22. Venter of abdominal segments VI and VII with medioventral pores 23
    Venter of abdominal segments without medioventral pores 25
23. Anal lobes unsclerotized; 21–31 small tritubular cerores present ventrally ..... *poensis* (Hambleton)
    Anal lobes sclerotized; four small tritubular cerores present ventrally 24

24. Multilocular disk pores with 6 or 7 loculi occurring ventrally, 18–25 present on abdominal segments VII–IX; eyes viewed in profile distinctly globular, constricted at their bases; falcate sensory setae long, moderately stout, tapering ..... *globoculus* (Hambleton)
Multilocular disk pores with 10–12 loculi occurring dorsally and ventrally, 35–40 present on abdominal segments VII–IX; eyes viewed in profile hemispherical, not constricted at their bases; falcate sensory setae comparatively short, stout ..... *theobromae* (Hambleton)

25. Anal-lobe area sclerotized 26
Anal-lobe area unsclerotized 30

26. Tubular ducts absent 27
Tubular ducts present 28

27. Ventrally 10 medium-sized tritubular cerores present on abdominal segments V–VIII; approximately 60 multilocular disk pores occurring ventrally on abdominal segments VII–IX ..... *neostangei* Miller and McKenzie
Ventrally 44 medium-sized tritubular cerores present on abdominal segments IV–VIII; approximately 100 multilocular disk pores occurring ventrally and some dorsally on abdominal segments III–IX ..... *stangei* McKenzie

28. Antennae normally about 165μ long, apical segment not twice as long as wide; 11 large tritubular cerores present dorsally ..... *latus* (Hambleton)
Antennae normally at least 200μ long, apical segment about twice as long as wide; 20 or more large tritubular cerores present dorsally 29

29. Multilocular disk pores scarce, a few present near vulva; circular pores present on segments V and VI ..... *pauciporus*, new species
Multilocular disk pores abundant, present dorsally and ventrally; circular pores absent ..... *graminis* (Hambleton)

30. Multilocular disk pores present on both surfaces 31
Multilocular disk pores present on venter only 32

31. Body length less than 1.00 mm; rostral loop extending beyond insertion of second pair of legs; derm with less than 20 tritubular cerores ..... *neomexicanus* McKenzie
Body length at least 1.36 mm; rostral loop not reaching insertion of second pair of legs; derm with more than 30 tritubular cerores ..... *caladii* Green

32. Tubular ducts absent; circular pores present dorsally across abdominal segments IV–VI; 11–21 multilocular disk pores present ventrally ..... *pritchardi* McKenzie
Tubular ducts present in small numbers; circular pores absent; 5–10 multilocular disk pores present ventrally 33

33. Falcate sensory setae moderately stout, not tapering; rostrum about 98μ long; cells in outer part of anal ring ovate elongate; larger cerores not surrounded by body setae ..... *nemoralis* (Hambleton)
Falcate sensory setae elongate, tapering; rostrum about 75μ long; cells in outer part of anal ring mostly sinuate; larger cerores surrounded by one to four body setae ..... *cyperalis* (Hambleton)

34. Normally with two circuli 35
Normally with one circulus, rarely with an additional small one 36

35. Tritubular cerores of one size; apical segment of antennae blunt, with slender, weakly clavate falcate setae; circulus not reticulose at orifice; claws stout ..... *bicirculus* McKenzie
Tritubular cerores of two sizes; apical segment of antennae not blunt, with stout falcate setae; circulus with orifice reticulose; claws elongate ..... *ornatus* (Hambleton)

36. Eyes absent 37
Eyes present, or sometimes absent from *nakaharai* 40

37. Body small, maximum body length 1.53 mm; anal lobes sclerotized; rostrum 51μ–57μ long 38
Body large, minimum body length 1.58 mm; anal lobes unsclerotized; rostrum 72μ–95μ long 39

38. Anal ring about 60μ wide, its setae about 87μ long, outer part with 25–30 large, angular, irregularly quadrate, mostly isolated cells; orifice of circulus narrow, less than one-half its basal width ..... *floridanus* Hambleton
Anal ring about 45μ wide, its setae about 55μ long, outer part with 19–20 small, elongate, oval cells almost touching end to end; orifice of circulus wide, more than one-half its basal width ..... *tropicalis*, new species

39. Tritubular cerores abundant, 125–130 present; apical segment of antennae twice as long as wide; sensory seta of segment V short, stout; tubular ducts about same size, of simple design ..... *ovatus*, new species
Tritubular cerores less abundant, 35–50 present; apical segment of antennae less than twice as long as wide; sensory seta of segment V narrow, elongate; tubular ducts varying in size, more complex in design ..... *relativus*, new species

40. Digitules short, setose, not reaching tip of claws 41
Digitules long, usually dilated at their apices and exceeding tip of claws 42

41. Digitules less than one-half as long as claws; hind claw about 24μ long; rostrum about 69μ long and 46μ wide; with 50–55 tritubular cerores; lobe setae shorter and more slender than ring setae ..... *arabicus*, new species
Digitules at least one-half as long as claws; hind claw about 40μ long; rostrum about 80μ long and 78μ wide; with 35–40 tritubular cerores; lobe setae about same size as ring setae ..... *maritimus* (Cockerell)

42. Anal-lobe area sclerotized 43
Anal-lobe area unsclerotized 45

43. Adult female not more than 1.50 mm long; falcate setae stout, weakly clavate; rostrum at least 50μ long ..... *favacirculus*, new species
Adult female more than 1.50 mm long; falcate setae not clavate; rostrum at least 75μ long 44

44. Anal ring about 80μ in diameter, its outer part with about 44 cells in double row in places; antennal segment VI twice as long as wide, its larger falcate setae tapering apically; rostral loop reaching to insertion of second pair of legs ..... *macgregori*, new species
Anal ring about 70μ in diameter, its outer part with 24–28 cells in single row; antennal segment VI not twice as long as wide, its larger falcate setae not tapering apically; rostral loop not reaching insertion of second pair of legs ..... *nakaharai*, new species

45. Adult female 0.87–1.40 mm long; rostrum not more than 55μ long; anal ring less than 60μ in diameter 46
Adult female 1.40–2.57 mm long; rostrum at least 65μ long; anal ring more than 65μ in diameter 48

46. Cells of outer part of anal ring subquadrate to triangulate; longest anal lobe seta not more than 60μ long ..... *insularis*, new species
Cells of outer part of anal ring oval to elongate oval; longest anal lobe seta not more than 48μ long 47

47. Cells of outer part of anal ring elongate, three to four times as long as wide; 8–13 small tritubular cerores present; falcate sensory setae narrow, elongate; rostral loop reaching about one-half distance to insertion of second pair of legs ..... *apizacos*, new species
Cells of outer part of anal ring oval elongate, about twice as long as wide; 40–60 small tritubular cerores present; falcate sensory setae moderately stout; rostral loop reaching insertion of second pair of legs ..... *simplex* (Hambleton)

48. With more than 75 tritubular cerores; rostrum at least 100μ long; cells of outer part of anal ring mostly isolated ---------- 49
With less than 75 tritubular cerores; rostrum less than 90μ long; cells of outer part of anal ring not isolated ---------- 50

49. Tubular ducts conspicuous, abundant, short, stout, strongly sclerotized, variable in size, many as large as cerores; outer part of anal ring with 48–50 cells; eyes small, rather depressed; with more than 100 tritubular cerores; rostrum about 77μ wide ---------- *polyporus*, new species
Tubular ducts inconspicuous, moderately abundant, elongate, neither variable in size nor as large as cerores; outer part of anal ring with 24–31 cells; eyes fairly prominent; with less than 100 tritubular cerores; rostrum about 98μ wide ---------- *atlanticus* (Hambleton)

50. Cells of outer part of anal ring mostly elongate or sinuate; with 20-23 tritubular cerores; rostral loop extending to insertion of second pair of legs ---------- *chilensis*, new species
Cells of outer part of anal ring mostly subtriangulate or irregularly ovate; with 30–55 tritubular cerores; rostral loop not reaching insertion of second pair of legs ---------- 51

51. Apical antennal segment usually elongate, about twice as long as wide; sensory seta of segment V weakly lanceolate; rostrum moderately elongate, averaging 88μ long, rostral loop extending more than one-half distance to insertion of second pair of legs; claws stout, wide at base; outer part of anal ring with 32–40 subtriangulate to quadrate cells arranged indiscriminately ---------- *cacticans* (Hambleton)
Apical antennal segment more robust, seldom twice as long as wide; sensory seta of segment V long, narrow, weakly curved; rostrum stout, broad, averaging 74μ long, rostral loop extending less than one-half distance to insertion of second pair of legs; claws elongate, narrow at base; outer part of anal ring with 22–30 elongate to irregularly ovate cells arranged more uniformly ---------- *leucosomus* (Cockerell)

DESCRIPTIONS OF SPECIES

Rhizoecus americanus (Hambleton)

(Figs. 1–9)

Morrisonella americana Hambleton, 1946a: 18.
Rhizoecus americanus: Ferris, 1953: 428; Hambleton, 1973: 64.

Adult Female.—Ovate elongate. Length, 1.50–1.63 mm; width, 0.80–0.89 mm. Antennae six-segmented, average length of segments: I, 41; II, 20; III, 30; IV, 23; V, 21; VI, 45; apical segment tapered, less than twice as long as wide, with three moderately stout, weakly tapered, falcate sensory setae and one nearly straight, slender, acute sensory seta; segment V with one smaller, narrow, elongate sensory seta. Interantennal space equal to combined length of three terminal segments. Eyes prominent, protuberant, occasionally longer than wide, lightly pigmented. Rostrum moderately stout, average about 75μ long, 56μ wide; rostral loop extending beyond halfway between insertion of first and second pair of legs. Cephalic plate broader than long, its lateral projections usually meeting a body seta near each laterocephalic margin. Dorsal ostioles conspicuous, their rims thickly sclerotized, surrounded by 8 or 9 body setae and 15–17 trilocular pores.

Legs moderately long, stout, average length of segments of hind pair: Trochanter, 55; femur, 121; tibia, 84; tarsus, 76; claw, 30; claw digitules short, setose, reaching half the length of long, slender claws.

Circulus absent. Anal lobes slightly protruding, usually somewhat sclerotized, each lobe with one seta 70μ–90μ long, two shorter setae, and two or three auxiliary body setae. Anal ring small, approximately 40μ–45μ in diameter, each of its setae about 56μ–58μ long, slightly more slender than longest lobe seta; cellular structure fairly clear; outer part of anal ring with 12 irregularly elongate or sinuate cells, each with 1 and sometimes 2 spicules near its center; cells of inner part of

ring more obscure, seldom more than 6 observed, elongate oval. Tritubular cerores of 3 sizes, large size occurring dorsally, 5 or 6 extending from head along dorsal line to abdominal segment VI, 6 submarginally along thorax and abdomen; medium-sized cerores about 8 in number, occurring submarginally on venter of abdominal segments V–VIII; 6–16 small cerores confined to venter of abdominal segments V–VIII. Multilocular disk pores with 7–10 loculi, most abundant on venter of posterior segments, elsewhere scattered ventrally and dorsally except on head there occurring only ventrally when present. Tubular ducts about same diameter or slightly larger than trilocular pores, short, strongly sclerotized at their bases, scattered dorsally and ventrally in small numbers over entire derm. Trilocular pores fairly evenly distributed, more abundant dorsally. Body setae moderately sparse, short except for few longer ones on head and along body margins.

Holotype.—Villavicencio, Colombia, 4-XI-44, E. J. Hambleton. **Paratypes.**—Twenty-three from Colombia, Cuba, Ecuador, Jamaica, Trinidad. USNM.

Host Plants.—*Andropogon virginicus, Aralia* sp., *Araucaria excelsa, Areca* sp., *Arecastrum romanzoffianum, Asparagus sprengeri, Caladium* sp., *Calliandra haematocephala, Calliandra* sp., *Callistemon* sp., *C. viminalis, Chamaecyparis* sp., *Chamaedorea elegans, Chlorophytum* sp., *Chrysalidocarpus lutescens, Chrysanthemum* sp., *Coccothrinax argentata, Coffea arabica, Collinia* sp., *Conocarpus erecta, Dieffenbachia maculata, D. picta, Dizygotheca elegantissima, Eragrostis maypurensis, Ernodea angusta, Euphorbia milii, Ficus nitida, Gardenia* sp., *Gnaphalium* sp., *Guettarda* sp., *Hemigraphis reptans, Hibiscus rosa-sinensis, Hibiscus* sp., *Isoloma* sp., *Kentia* sp., *Kohleria* sp., *Lantana* sp., *Liriope* sp., *Malphighia coccigera, Melaleuca leucadendron, Nephthytis* sp., *Paspalum conjugatum, P. fimbriatum, Peperomia pellucida, Phoenix loureirii, Physalis pubescens, Pothos* sp., *Pyracantha coccinea, Quercus* sp., *Rhaphiolepis* sp., *Saintpaulia ionantha,* undetermined species of Gramineae, Orchidaceae, Urticaceae, fern.

Distribution.—Florida, British West Indies, Mexico, Central America, South America.

Florida: Altamonte Springs, 5–VIII–59, C. O. Youtsey. Bradenton, 3–IX–70, S. L. Poe. Clarcona, 9, 16–XI–70, 13, 15–IV–71, F. L. Ware. Delray Beach, 16–II–71, W. E. Wyles and R. A. Long. Fern Park, 27–VIII–62, C. O. Youtsey; 22–IV–65, J. W. McLeod; 6–18–XI–70, 16–XII–70, H. M. Van Pelt; 19, 27–I–71, G. W. Dekle. Flamingo, 18–II–70, E. J. Hambleton. Gainesville, 4–VIII–71, J. Perry. Grassy Key, 21–X–72, W. H. Pierce. High Point, 15–II–71, E. W. Miller. Largo, 4, 16–II–71, K. C. Hickman, E. W. Miller, and G. T. Williams. Middle Torch Key, 20–X–72, W. H. Pierce. Naranja, 30–IX–72, W. H. Pierce. No Name Key, 3–II, 21–X–72, W. H. Pierce. N. Fort Meyers, III–71, W. T. Walsh. N. Miami Beach, 18–XII–72, E. J. Hambleton. Orlando, 9–II–71, F. L. Ware. Osprey, 5–II–71, J. R. McFarlin and C. J. Bickner. Palma Sola, 19–IX–72, C. J. Bickner. Palmetto, 1–VII, 14–X, 15–IX–70, J. R. McFarlin and C. J. Bickner; 3–VIII–70, C. J. Bickner. St. Petersburg, 12–II–71, K. C. Hickman. Sarasota, 22–II–71, J. R. McFarlin. Seminole, 12–II–71, K. C. Hickman. Snead Island, 11, 16–XI, 24–XII–70, 2–IV–71, J. R. McFarlin. Sugarloaf Key, 3–II–72, W. H. Pierce. Tallevast, 17–II–71, 9–I–73, J. R. McFarlin. Upper Key Largo, 22–VIII–68, R. E. Woodruff. Winter Garden, 21–VIII–67, R. J. Griffith; 9–XII–70, G. W. Dekle, D. Short, and S. L. Poe; 25–X–72, F. L. Ware.

British West Indies: Trinidad, 23–XI, 7, 31–XII–43, A. H. Strickland.

Colombia: Chinchina, 1–IV–56, S. E. Flanders. Fusagasugá (Cund.), 17–VIII–71, F. Mosquero and H. Martin. Villavicencio, 4–XI–44, E. J. Hambleton.

Costa Rica: Las Cruzes, 6 mi E. of San Vito, 18–II–70, M. Kosztarab.

Cuba: Santiago de las Vegas, 1–VIII–45, S. C. Bruner and E. J. Hambleton.

Ecuador: Pichilingue, 1–X–44, E. J. Hambleton.

Honduras: La Lima, IX, X–67, C. Evers.

Jamaica: Interception at Hoboken, N.J., 11–IV–27, W. T. Ehiger.

Mexico: Vera Cruz, 10 mi SW. of Jalapa, 13, 16–VII–67, D. R. Miller and J. Villanueva B. 10 mi S. of Xiutetelco, 28–II–72, D. R.

Miller and F. D. Parker. Interception at Brownsville, Tex., 23–VI–49.

Panama: Canal Zone, Summit Gardens, 14–VII–48, E. J. Hambleton.

Puerto Rico: El Yunque, 7–II–72, E. J. Hambleton.

Virgin Islands: St. Croix, 21–III–73, G. W. Dekle and M. Murphey.

Discussion.—The types and more than 200 additional specimens of *americanus* have been studied. This species usually has sclerotized anal lobes and tubular ducts, structures that were reported missing in the original description. Multilocular disk pores with 6 loculi were observed with the normal 10 loculi in some Florida specimens collected on *Araucaria excelsa*.

In recent years *americanus* has become a pest of considerable importance in Florida nurseries. It was first collected in the State at Altamonte Springs in August 1969. Although widely distributed in the State, it is unknown elsewhere in the United States except an isolated infestation in New Jersey. The diverse host list and wide distribution of this species are indicative of its potential as a possible greenhouse pest in other parts of the country. Costa Rica, Honduras, Panama, Puerto Rico, Mexico, and the Virgin Islands represent new distribution records for this species.

Among the more important distinguishing features of *americanus* are its three sizes of tritubular cerores, small anal ring, and sclerotized anal lobes.

Rhizoecus apizacos, new species

(Figs. 10–15)

Adult Female.—Oval elongate, tapering toward extremities. Length, 0.97–1.38 mm; width, 0.41–0.74 mm. Antennae six-segmented, moderately short, stout, closely placed near tip of head, segments in following proportions: I, 25; II, 11; III, 14; IV, 11; V, 13; VI, 39; apical segment less than twice as long as wide, with three very slender, rather strongly curved, falcate sensory setae, subequal in length, and one shorter, spinelike sensory seta near its apex; segment V with one short, slender, weakly clavate sensory seta. Interantennal space less than length of segment I. Eyes small, protuberant, weakly pigmented. Rostrum short, stout, about 49μ long, 45μ wide; rostral loop reaching about halfway between insertion of first and second pair of legs. Cephalic plate longer than wide, length about 37μ, narrowed anteriorly, extending to or beyond base of antennae. Dorsal ostioles inconspicuous, their rims narrow, weakly sclerotized.

Legs short, moderately stout, average length of segments of hind pair: Trochanter, 25; femur, 65; tibia, 58; tarsus, 46; claw, 18; claw digitules slender, their tips dilated, extending beyond weakly curved claws.

With one conical circulus about 11μ wide, diameter at orifice about 5μ. Anal lobes undeveloped, unsclerotized, each lobe area with three long, slender setae, longest about 48μ long, and four or five shorter body setae. Anal ring clearly defined, averaging approximately 45μ in diameter, its setae 50μ long, about same length as longest lobe setae but much stouter; outer part of anal ring with 16–18 irregularly sinuate cells; cells on inner part of ring larger, more irregular in shape, numbering 8–10, bordered internally by clouded semicircular cells. Tritubular cerores small, their ducts about 5μ–6μ long, few in number, occurring dorsally, three on head, four on thorax, six or seven on abdomen. Multilocular disk pores absent. Tubular ducts minute, about one-half diameter of trilocular pore, few in number, at least two each on abdominal segments V–VIII. Trilocular pores evenly distributed. Body setae mostly short, longest on posterior abdominal segments.

Holotype.—Tlaxcala State, 26 km N. of Apizacos, Mexico, 12-VII-67, D. R. Miller and J. Villanueva B.; UCD. **Paratypes.**—Three, same data as holotype; one UCD, two USNM.

Host Plant.—Unknown.

Distribution.—Known only from type locality.

Discussion.—*R. apizacos* superficially resembles *simplex*, but new species has larger legs, its antennae are more closely placed, and the falcate sensory setae are longer and more slender than those of *simplex*. Other major differences separating the two species are in the key.

Rhizoecus arabicus, new species

(Figs. 16–23)

Adult Female.—Elongate oval. Length, 0.84–1.73 mm; width, 0.46–0.87 mm. Antennae six-segmented, segments in following proportions: I, 35; II, 21; III, 33; IV, 16; V, 17; VI, 45; apical segment rather stout, less than twice as long as wide, with three falcate sensory setae and one more slender, shorter, sharply tapered sensory seta; segment V with one slender, weakly lanceolate sensory seta. Interantennal space about equal to combined length of three terminal segments. Eyes moderately prominent, weakly pigmented. Rostrum rather elongate, about 68μ long, 46μ wide; rostral loop extending to or slightly beyond insertion of second pair of legs. Cephalic plate of medium size, irregularly subquadrate, with two vacuoles near its posterior extremity. Dorsal ostioles indistinct, appearing as if unsclerotized.

Legs well developed, of moderate size, length of segments of hind pair: Trochanter, 43; femur, 100; tibia, 95; tarsus, 57; claw, 24; claw digitules short, setose, reaching midlength of claws, inner margin of claws almost straight.

With one conical circulus, about as long as wide, its orifice faveolate. Anal lobes undeveloped, unsclerotized, each lobe area with one seta about 62μ long, two shorter elongate setae, one or two auxiliary setae, and usual trilocular pores. Anal ring well defined, about 57μ wide, its setae about 90μ long, stouter and longer than lobe setae; outer part of anal ring with approximately 24–30 fairly large, irregularly shaped, rather angulate, quadrate to ovate cells, ends of most not touching; inner part of anal ring with 13–14 larger, irregularly elongate cells bordered inside by clouded area of semicircular cells. Tritubular cerores of medium to small size, their ducts weakly tapered, projecting well above derm, 50–55, widely distributed dorsally and ventrally. Multilocular disk pores absent. Tubular ducts narrow, elongate, rather uniformly distributed but less common on head and thorax. Trilocular pores most abundant on head and posterior abdominal segments. Body setae short, some longer setae dorsally on head and posterior abdominal segments.

Holotype.—Chinchina, Colombia, April 1956, S. E. Flanders, with one paratype and one unidentified *Neorhizoecus* on same slide; USNM.
Paratypes.—Three, same data as holotype, two partially mutilated; two Cota, Costa Rica, 20–V–57, E. B. Dixon, on two slides, one slide also bearing three immatures of *R. campestris;* USNM.

Host Plants.—*Coffea arabica,* undetermined Gramineae, in soil.

Distribution.—Colombia, Costa Rica.

Discussion.—In the key to species, *arabicus* occupies the same couplet with *maritimus.* It may readily be distinguished from the latter by its shorter digitules, smaller rostrum, larger number of tritubular cerores, and smaller anal ring. The cells of the outer part of the anal ring of *arabicus* are mostly quadrate, whereas those of *maritimus* are mostly oval elongate.

Rhizoecus associatus (Hambleton)

(Figs. 24–29)

Morrisonella associata Hambleton, 1946a: 20.
Rhizoecus associatus: Ferris, 1953: 430; McKenzie, 1967: 372.

Adult Female.—Rather stout, elliptical, much narrower toward head. Length, 1.26–1.94 mm; width, 0.58–1.21 mm. Antennae six-segmented, placed near apex of head, segments in following proportions: I, 39; II, 25; III, 20; IV, 18; V, 17; VI, 43; apical segment less than twice as long as wide, with three stout, apically tapered, clavate falcate sensory setae and one elongate, nearly straight sensory seta near its apex; segment V with one elongate, narrow sensory seta; all segments with extremely long setae of usual type. Interantennal space equal to length of segment I. Eyes small, protuberant, pigmented. Rostrum long, 75μ–78μ in length, 50μ wide; rostral loop extending to or slightly beyond insertion of second pair of legs. Cephalic plate large, irregularly triangulate, 54μ long, 58μ wide, with four or five setae bordering its periphery. Dorsal ostioles weakly developed, inconspicuous.

Legs moderately short, average length of segments of hind pair: Trochanter, 41; femur,

80; tibia, 62; tarsus, 52; claw, 30; claw digitules short, setose, almost reaching midlength of claws.

Circulus absent. Anal lobes roundly developed, heavily sclerotized, each lobe with 4 or 5 elongate setae of varying lengths, longest about 80μ, 3 or 4 smaller body setae, and 8–10 trilocular pores. Anal ring about 65μ in diameter, its setae about 63μ in length, stouter than lobe setae; outer part of anal ring with 12 moderately large, elongate cells, each with several minute spicules; inner part of ring with 6–8 cells larger than those of outer part and more irregular in shape, lying adjacent to large darkened semicircular cells. Tritubular cerores large, varying somewhat in size, 60–74 occurring dorsally and ventrally over entire derm. Multilocular disk pores present dorsally and ventrally, occurring in irregular, transverse rows, absent from head. Tubular ducts absent. Trilocular pores evenly distributed, sparse in areas on thorax and between segments. Body setae short, sparse, a few longer setae on head, posterior abdominal segments, and along body margin.

Holotype.—Guatemala, along highway between Quetzaltenango and Totonicapan, 10,000 ft, 20-V-45, E. J. Hambleton. **Paratypes.**—Three taken with holotype. USNM.

Host Plants.—*Alchemilla orbiculata,* unidentified Gramineae.

Distribution.—California, Guatemala, Mexico.

California: Santa Cruz, 9–II–64, D. R. Miller and J. A. Froebe.

Guatemala: From the type locality.

Mexico: 10 mi S. of Texcoco, State of Mexico, 12–VIII–67, D. R. Miller and J. Villanueva B.

Discussion.—Ferris (*1953*) doubted that *associatus* differed from *distinctus.* His key characters for separating the two species are unreliable because the inner row of "pores" of the anal ring appears clouded in all species of *Rhizoecus.* Staining techniques possibly alter the degree of cloudiness in some specimens. McKenzie (*1967*), using the identical characters in his key, likewise overlooked the important differences between these mealybugs. The basic differences separating the two species are in the key. Also, *associatus* has longer appendages than *distinctus* and its falcate sensory setae are clavate. The larger number of anal-lobe setae and the more protruding anal lobes readily distinguish *associatus* from *distinctus.*

Rhizoecus atlanticus (Hambleton), new combination

(Figs. 30–39)

Ripersiella atlantica Hambleton, 1946a: 62.

Adult Female.—Oval elongate, moderately stout. Length, 1.76–2.20 mm; width, 0.94–1.88 mm. Antennae six-segmented, elongate, widely spaced, average length of segments: I, 41; II, 24; III, 29; IV, 19; V, 20; VI, 59; apical segment about twice as long as wide, with three long, rather slender, tapering, falcate sensory and one shorter, sharply tapered sensory seta; segment V with 1 short, narrow, tapered sensory seta. Interantennal space equal to combined length of segments II–V. Eyes fairly prominent, weakly pigmented. Rostrum very stout, 104μ long, slightly longer than wide; rostral loop extending halfway to insertion of second pair of legs. Cephalic plate small, irregular in shape, with two vacuoles. Dorsal ostioles almost indistinguishable.

Legs fairly large, length of segments of hind pair: Trochanter, 52; femur, 118; tibia, 107; tarsus, 65; claw, 27; claw digitules long, dilated at tips, extending slightly beyond tip of rather stout, moderately curved claws.

With one elongate, conical circulus. Anal lobes simple, undeveloped, each lobe area with three elongate setae, two about 87μ long, longer and stouter than third, and four or five smaller auxiliary setae. Anal ring large, 78μ–85μ in diameter, each of its setae shorter and somewhat narrower than largest lobe seta; outer part of anal ring with 24–31 mostly isolated, irregularly oval to almost circular cells, varying in size, each with tiny spicule; cells of inner part of ring approximately 22 in number, larger, many touching; clouded area indistinct except for large oval cell structure. Tritubular cerores small, their ducts long, slender, tapering, and divaricating, projecting well above derm, about 95–100 present dorsally and ventrally in transverse series encircling segments. Multilocular disk pores absent. Tubular ducts fairly abundant, occur-

ring over most of derm. Mushroomlike bodies, similar to those found in *polyporus*, widely distributed over derm. Trilocular pores moderately abundant, evenly distributed. Body setae longer on head, elsewhere varying in length, uniformly distributed.

Holotype.—Guarujá, State of São Paulo, Brazil, 22-VIII-35, B. L. Ribeiro and E. J. Hambleton; on slide with four paratypes. **Paratypes.**—Ten on two slides. USNM.

Host Plant.—*Axonopus* sp.

Distribution.—Known only from the type locality.

Discussion.—No other known species of *Rhizoecus* resembles *atlanticus*. Its large, broad rostrum, finely tapered ceroris ducts, and unusual cellular structure of the anal ring set it apart from all other species. This mealybug was originally collected along the Atlantic seacoast with *R. nitidalis* and *Brevicoccus clavisetosus* Hambleton.

Rhizoecus bicirculus McKenzie

(Figs. 40–45)

Rhizoecus bicirculus McKenzie, 1967: 374.

Adult Female.—Elongate oval. Length, 1.10–2.55 mm; width, 0.40–1.26 mm. Antennae six-segmented, short, stout, weakly clavate, length of segments: I, 21; II, 12; III, 17; IV, 10; V, 11; VI, 28; apical segment broad, with three fairly stout, clavate, falcate sensory setae and one narrow, elongate sensory seta; segment V with very short, clavate sensory seta. Interantennal space less than width of segment I. Eyes small, inconspicuous. Rostrum small, about 42μ long, 28μ wide; rostral loop not reaching halfway to insertion of second pair of legs. Cephalic plate longer than wide, about 28μ long. Dorsal ostioles small, weakly sclerotized.

Legs short, stout, length of segments of hind pair: Trochanter, 24; femur, 54; tibia, 47; tarsus, 30; claw, 12; claw digitules long, dilated at their tips, exceeding basally stout, weakly curved claws.

With two depressed circuli situated ventrally on segments III and IV, measuring 10μ–13μ in diameter, their circular rims strongly sclerotized. Anal lobes undeveloped, each lobe area with three elongate setae, subequal in length, longest about 34μ long, and several shorter body setae. Anal ring about 40μ wide, its setae about 34μ long, stouter than lobe setae; outer part of anal ring with 18 elongate oval cells, varying in size, mostly with spicules; inner anal ring with 8–10 larger, more irregularly elongate cells, lying adjacent to rather indistinct clouded area. Tritubular cerores small, their ducts short, 20–24 present, most occurring dorsally. Multilocular disk pores absent. Tubular ducts smaller in diameter than trilocular pore, present dorsally and ventrally, scattered on abdomen, sparse on thorax, absent from head. Trilocular pores rather sparsely distributed over entire derm. Body setae mostly short, slender.

Holotype.—Trinity County, 6 mi NE. of Weaverville, Stony Creek on Lake Trinity, Calif., 22-V-63, R. F. Wilkey; UCD. **Paratypes.**—Two, one USNM.

Host Plants.—*Ceanothus pumilus, Eriogonum* sp., *Lotus scoparius,* unidentified Gramineae.

Distribution.—Type locality and the following records: California: Merced County, 18 mi W. Los Banos, 17–II–67, T. R. Haig. Santa Barbara County, South Ridge Station, Santa Cruz Island, 6–V–68, D. R. Miller and R. W. Rust. South Rim Station, Santa Cruz Island, 9–V–68, D. R. Miller.

Discussion.—This unusual species is easily recognized by its two large circuli, its short, stout antennae, and small rostrum. Contrary to McKenzie's belief, *bicirculus* is not closely related to *cacticans*. The two species are not similar morphologically.

Rhizoecus bituberculatus McKenzie

(Figs. 46–54)

Rhizoecus bituberculatus McKenzie, 1960b: 743; 1967: 376.

Adult Female.—Oval elongate. Length, 0.82–1.20 mm; width, 0.34–0.40 mm. Antennae six-segmented, moderately stout, segments in following proportions: I, 33; II, 19; III, 31; IV, 14; V, 17; VI, 44; apical segment tapered, twice as long as wide, with three fairly stout, weakly tapered, falcate sensory setae and one

elongate, spinelike sensory seta; segment V with one shorter, weakly lanceolate sensory seta. Interantennal space equal to length of segment I. Eyes absent. Rostrum about 65μ long, 45μ wide; rostral loop extending to or beyond insertion of second pair of legs. Cephalic plate about 38μ long, narrower anteriorly. Dorsal ostioles well developed, strongly sclerotized, posterior pair surrounded by concentration of trilocular pores and body setae.

Legs relatively short, stout, length of segments of hind pair: Trochanter, 35; femur, 77; tibia, 66; tarsus, 50; claw, 17; claw digitules weakly dilated apically, extending beyond claws.

With one faveolate, depressed, conical circulus, its orifice about 11μ in diameter. Anal lobes weakly developed, each with small sclerotized patch, three elongate setae, subequal in length, longest approximately 52μ long. Anal ring well defined, diameter 45μ, its setae about 63μ long, slightly weaker than strongest lobe setae; outer part of anal ring with approximately 14–16 oval, elongate cells of varying lengths, each with spicule; inner part of ring with smaller number of larger, more irregular cells lying adjacent to cellular darkened area. Bitubular cerores small, elongate, relatively stout, their ducts projecting well above derm, 45–55 occurring dorsally and ventrally. Multilocular disk pores more abundant ventrally in abdominal and thoracic areas, scattered and in small groups, dorsally limited to posterior abdominal area. Tubular ducts scattered dorsally and ventrally. Trilocular pores uniformly distributed dorsally, on venter in patchlike areas. Body setae varying in length, rather sparse, usually occurring with trilocular pores.

Holotype.—Placer County, 4 mi W. of Newcastle, Calif., 21-III-58, W. H. Lange, L. M. Smith, and R. O. Schuster; UCD. **Paratypes.**—Many, same location as holotype, 15–IV–58, 10–III–59, L. M. Smith and R. O. Schuster; UCD, two USNM.

Host Plant.—Unknown, taken in soil under *Quercus wislizenii.*

Distribution.—California, Indiana, North Carolina.

California: Type locality and near Nashville, El Dorado County, 25–I–58, L. M. Smith and R. O. Schuster. Three mi N. of Placerville, 18–V–61, R. O. Schuster.

Indiana: Lawrence County, Spring Mill State Park, 7–XI–71, J. A. McBride. (In rotting wood and soil, via Berlese trap.)

North Carolina: Duke University Forest, 24–II–45, A. S. Pearse.

Discussion.—This small native species is one of the few with bitubular cerores. The presence of a circulus, the bitubular cerores, and lack of eyes distinguish *bituberculatus* from its nearest relatives. The multilocular disk pores of this species display a considerable difference in size and their loculi vary from 8 to 12 instead of from 10 to 12, the number in most species. Tubular ducts, reported to be absent in the original description, are present in *bituberculatus.*

Rhizoecus boharti McKenzie

(Figs. 55–61)

Rhizoecus boharti McKenzie, 1960a: 139.

Adult Female.—Elongate oval, narrower toward apex. Length, 1.05 mm; width, 1.00 mm. Antennae six-segmented, relatively small, length of segments: I, 33; II, 22; III, 26; IV, 17; V, 19; VI, 41; apical segment about twice as long as wide, with three elongate, falcate sensory setae and one elongate, spinelike sensory seta near apex; segment V with one small, short, rather narrow sensory seta. Interantennal space equal to length of segment I. Eyes small, protruding. Rostrum elongate, 66μ long, 36μ wide; rostral loop reaching to insertion of second pair of legs. Cephalic plate broadly rounded, weakly pigmented. Dorsal ostioles well developed, their rims strongly sclerotized.

Legs comparatively small, length of hind leg segments: Trochanter, 29; femur, 72; tibia, 64; tarsus, 44; claw, 17; claw digitules elongate, their tips weakly dilated, exceeding moderately stout claws.

Circulus absent. Anal lobes undeveloped, each lobe area with sclerotized patch, three elongate setae, longest about 42μ long, and several short body setae. Anal ring 45μ wide, its setae about 44μ long, slightly longer and stouter than lobe setae; outer part of ring with

16 oval, elongate cells with spicules; inner part of ring with 10–12 larger, more irregular cells lying adjacent to diffused shaded area. Bitubular cerores small, their ducts elongate, weakly tapered, about 55 present, occurring dorsally and ventrally. Multilocular disk pores present, confined almost entirely to posterior abdominal segments, dorsally only two pores present on segment VIII. Tubular ducts short, smaller in diameter than trilocular pore, distributed over entire surface. Trilocular pores distributed dorsally and ventrally, fewer present between segments. Body setae mostly short, slender.

Holotype.—Cochise County, 5 mi SE. of Apache, Ariz., 11–VIII–58, R. M. Bohart; UCD.

Host Plant.—Unknown, collected in soil via Berlese trap.

Distribution.—Known only from type locality.

Discussion.—This rather unique species with six-segmented antennae and bitubular cerores has no circulus. These features alone separate it at once from all known species of *Rhizoecus* in the Western Hemisphere.

Rhizoecus cacticans (Hambleton)

(Figs. 62–69)

Ripersiella cacticans Hambleton, 1946a: 64.
Rhizoecus cacticans: Ferris, 1953: 432; McKenzie, 1960b: 745; McKenzie, 1967: 379; Hambleton, 1973: 65.
Rhizoecus epiphylli Ferris, 1953: 442; McKenzie, 1960b: 745.
Rhizoecus leucosomus (Cockerell): McKenzie, 1967: 398 (misidentification in part); Gonzalez and Charlin, 1968: 112 (misidentification).

Adult Female.—Oval elongate, stout. Length, 2.25–2.57 mm; width, 0.98–1.18 mm. Antennae six-segmented, rather elongate, widely spaced, average length of segments: I, 39; II, 25; III, 45; IV, 18; V, 20; VI, 55; apical segment usually twice as long as wide, with three rather narrow, elongate, falcate sensory setae and one more slender, strongly tapered sensory seta; segment V with one shorter, narrow, elongate sensory seta. Interantennal space equal to approximately length of segments IV–VI taken together. Eyes moderately large, protuberant, pigmented. Rostrum rather long, averaging about 88μ long, 65μ wide; rostral loop extending to or slightly beyond halfway to insertion of second pair of legs. Cephalic plate irregularly triangulate, 35μ wide at base, with two large vacuoles. Dorsal ostioles inconspicuous, their rims lightly pigmented.

Legs of normal size, moderately stout, elongate, length of segments of hind pair: Trochanter, 51; femur, 124; tibia, 104; tarsus, 62; claw, 20; claw digitules elongate, weakly dilated at tips, extending beyond stout, curved claws.

With one strongly sclerotized, conical circulus, about as long as wide. Anal lobes undeveloped, unsclerotized, each lobe area with three elongate setae, one measuring 75μ–95μ long, remaining two shorter, more slender, and not as long as anal-ring setae. Anal ring approximately 75μ in diameter, its cellular structure clear, distinct, ring setae ranging between 92μ and 105μ long; outer part of anal ring with 32–40 subtriangulate to quadrate, indiscriminately arranged cells of large size; cells of inner part 20–22, somewhat larger than those of outer part, irregular in shape, lying end to end, bordering clouded area of semicircular cells. Tritubular cerores small, between 50 and 55 present, occurring dorsally and ventrally, usually 4 or 5 to segment, their individual ducts not reaching far above derm. Multilocular disk pores absent. Tubular ducts minute, of smaller diameter than trilocular pore, distributed over entire derm but more prominent on abdomen. Trilocular pores numerous, evenly distributed. Body setae 20μ–55μ long, rather uniformly arranged.

Holotype.—Cayambe, Ecuador, 11-X-44, E. J. Hambleton. **Paratypes.**—Twenty-three from Argentina, California, Ecuador, and Germany. USNM.

Host Plants.—*Bromus unioloides, Cyperus* sp., *Dudleya farinosa, Echeveria* sp., *Eleusine indica, Epiphyllum* sp., *Holcus lanatus, Kalanchoe* sp., *K. tomentosa, Kleinia* sp., *Lobivia shaferi, Lobivia* sp., *Lolium perenne, Mammillaria* sp., *Mesembryanthemum* sp., *Opuntia* sp., *Sempervivum* sp., *S. tectorum, Senecio mikanioides,* undetermined Cactaceae.

Distribution.—California, Florida, Argentina, Chile, Ecuador, Honduras.

California: Berkeley, 7–VI–48, C. A. Hansen. Dale City, 18–I–57, D. J. Bingham and E. L. Labadie. Davis, 11–II–65, W. Russell; 24–II–65, Mrs. W. A. Williams. Fallbrook, 11–III–57, K. F. Sims. Fontana, 1–V–34, E. P. Bradbury. Leucadia, 8–XII–55, D. Sprague. Niles, 25–II–48, A. E. Pritchard. Ontario, 26–XII–48, C. R. Tower. Pacifica, 8–II–64, D. R. Miller and J. A. Froebe. Santa Cruz, 26–III–64, R. W. Nutter. Watsonville, 29–XI–57, D. H. Shaw.

Florida: St. Petersburg, 9–II–73, C. K. Hickman. Sanford, 15–II–63, C. O. Youtsey.

Argentina: Locality unknown, intercepted at Washington, D.C., 23–XI–36, D. P. Limber and W. B. Wood.

Chile: Cautín Province, 1 km N. Villarrica, 29–IV–65, R. H. Gonzalez. Cuesta de Pucalan, La Calera, 1961, L. M. Smith. La Cruz, 4, 15–IV–61, L. M. Smith. One km E. Maitencillo, 16–III–61, L. M. Smith. Olmue, 21–VI–61, L. M. Smith. Valparaiso Province, Quebrado El Soldado, El Cobre, 15–VII–61, L. M. Smith. Jardim Botanica Nacional, Vina del Mar, 16–VI–61, 4–VII–61, L. M. Smith; 15–VI–65, R. H. Gonzalez.

Ecuador: Alausi, 7–X–44, Cayambe; 11–X–44, Salcedo; 4–X–44, E. J. Hambleton.

Honduras: La Lima, X–67, C. Evers.

Discussion.—This species has been confused with *leucosomus*, *floridanus*, and the new species *chilensis* and *nakaharai* described herein. The misidentification of *cacticans* is believed to have been due primarily to overlooking detailed morphological structures. Characters of major importance in separating *cacticans* from its nearest relatives are its unsclerotized anal lobes, elongate rostrum, length of apical antennal segment, and the number, shape, and size of the cells in the outer part of the anal ring. In *floridanus* and *nakaharai* the anal lobes have rather small, elongate sclerotized areas. Several differences separate *leucosomus* and *cacticans*. The former possesses a shorter and stouter rostrum, less elongate apical antennal segment, and fewer elongate, irregularly ovate cells in the outer part of the anal ring. These cells are also smaller and more uniformly arranged in *leucosomus*. Other characters may be referred to in the key.

Rhizoecus caladii Green

(Figs. 70–71)

Rhizoecus caladii Green, 1933: 53.

Adult Female.—Oval elongate, moderately stout. Length, 1.36–1.65 mm; width, 0.74–0.91 mm. Antennae six-segmented, average length of segments: I, 38; II, 21; III, 33; IV, 28; V, 22; VI, 48; apical segment longest, with three rather long, slender, gradually tapering, falcate sensory setae and one slender, spinelike sensory seta near its apex; segment V with one short, slender falcate seta. Interantennal space about equal to combined length of segments V and VI. Eyes protuberant, lightly pigmented. Rostrum elongate, about 78μ long, 51μ wide; rostral loop not reaching insertion of second pair of legs. Cephalic plate not observed. Dorsal ostioles clearly defined, their rims sclerotized, surrounded by numerous trilocular pores and body setae.

Legs fairly large, average length of segments of hind pair: Trochanter, 55; femur, 123; tibia, 88; tarsus, 76; claw, 33; claw digitules short, setose, not reaching one-half length of narrow, elongate, finely pointed claws.

Circulus absent. Anal lobes very weakly protruding, each lobe area with one seta 78μ long and two shorter setae. Anal ring about 45μ in diameter, its structure poorly defined, cells appearing elongate; its setae 50μ–60μ long. Tritubular cerores of 2 sizes, their ducts short, stout, about 20 of larger size occurring dorsally, 6 extending along median line from head to abdominal segment VI, 4 submarginally on abdomen; small cerores occurring ventrally, total of 14 present submarginally and near median area of abdominal segments V–VIII. Multilocular disk pores present ventrally, moderately crowded near vulva, scattered elsewhere on abdomen and thorax, absent from head. Tubular ducts small, scarce, few near abdominal margins. Trilocular pores rather evenly distributed. Body setae short, sparse, inconspicuous.

Topotypes.—Three, Surinam, Dutch Guiana, 10-X-31, G. Bunzli; BM.

Host Plants.—*Caladium bicolor*, *Coffea arabica*.

Distribution.—Known only from type locality.

Discussion.—Redescribed from three topotypes determined by F. Laing. It is not known if the three topotype specimens were seen by Green. I am convinced nevertheless that they are conspecific with Green's type specimen of *caladii*.

R. caladii resembles *poensis* from Colombia but differs from it in lacking clusters of medioventral pores and by possessing shorter and less conspicuous body setae and narrower claws.

Rhizoecus californicus Ferris

(Figs. 72–80)

Rhizoecus californicus Ferris, 1953: 434; McKenzie, 1967: 381.

Adult Female.—Elongate oval, moderately stout. Length, 1.20–1.50 mm; width, 0.75–1.00 mm. Antennae five-segmented, weakly clavate, average length of segments: I, 22; II, 24; III, 19; IV, 17; V, 60; apical segment more than twice as long as wide, with four falcate sensory setae of medium size, longest about equal to width of segment V, and one narrow, spinelike sensory seta. Interantennal space less than length of segment V. Eyes usually inconspicuous, weakly pigmented, often difficult to observe. Rostrum short, average length 55μ, width 42μ; rostral loop rather short, seldom extending to insertion of second pair of legs. Cephalic plate broader than long, about 50μ wide. Dorsal ostioles prominent, their rims heavily sclerotized.

Legs stout, exhibiting some variation in size, hind pair measurements of largest specimen: Trochanter, 44; femur, 92; tibia, 83; tarsus, 55; claw, 22; claw digitules long, dilated at tips, extending beyond stout, curved, acute claws.

With one rather small, truncate to dome-shaped circulus with reticulated oral surface. Anal lobes showing some development, each with strongly sclerotized area equal in size to width of anal ring, with three elongate setae, subequal in length and size, and several body setae. Anal ring about 40μ in diameter, each of its setae slightly more slender than largest lobe seta and usually about as long as latter; outer part of anal ring with 14–16 small, uniform, elongate, oval cells, each with spicule; inner ring with 10 or 12 larger, irregularly elongate cells bordered inside by darkened area of semicircular cell structure. Tritubular cerores of 2 sizes present, their ducts short and stout, smaller size less numerous, more common ventrally, total number of cerores ranging between 130 and 200, situated mostly in rows across segments and scattered on head. Multilocular disk pores present, confined to posterior abdominal segments ventrally, from 27 to 45 distributed along margins of segment VII, around vulva, and across segment IX. Tubular ducts rather elongate, with broadly rounded sclerotized bases, distributed on both surfaces, as many as four on each abdominal segment. Trilocular pores fairly evenly distributed, less common in thoracic area. Body setae sparse, mostly short, slender.

Lectotype.—Berkeley, Calif., 23-IV-46, H. M. Butterfield, with five **paralectotypes** on one slide, E. O. Essig collection, UCD.

Host Plants.—*Artemisia douglasiana, Dipsacus* sp., *Fragaria chiloensis, Helianthus* sp., *Polygonum* sp., in soil under chaparral, in grassland.

Distribution.—California.

California: Berkeley, 2–III–58, L. M. Smith. One mi W. Bolinas, 19–I–60, W. G. Iltis and C. Judson. Two mi NE. Bolinas, 27–VIII–63, D. R. Miller. Davis, 23–IX–61, M. E. Irwin. Goat Rock, 10–X–67, H. L. McKenzie. Guerneyville, 30–V–60, C. Judson. Millbrae, San Andres Lake, XI–57, D. W. Price. Palermo, 23–X–70, E. Remmurs. Six mi E. Point Reyes, 1–III–60, L. M. Smith and R. O. Schuster.

Discussion.—The original description of *californicus* by Ferris (*1953*) was based on a collection of six female specimens mounted on a single slide. Since no type was designated, I have designated the specimen on the right side of the slide, nearest the label to the right, as the lectotype.

In addition to the types, more than 28 specimens of this interesting California species have been studied. It is readily distinguished by having five-segmented antennae, an average of over 150 tritubular cerores of two

sizes, multilocular disk pores, and a circulus. The heavily sclerotized anal lobes are also a good diagnostic character. Although considered absent in the original description, tubular ducts are present in *californicus*. It may also be noted that the eyes are so weakly pigmented that they often are not observed.

Rhizoecus campestris Hambleton

(Figs. 81–88)

Rhizoecus campestris Hambleton, 1946a: 51; Ferris, 1953: 436.

Adult Female.—Elongate oval. Length, 1.30–1.53 mm; width, 0.46–0.60 mm. Antennae strongly geniculate, clavate, five-segmented, segments measuring as follows: I, 43; II, 22; III, 19; IV, 13; V, 69; apical segment more than twice as long as wide, with three stout, weakly clavate sensory setae, one shorter clavate seta near its base, and one elongate spine-like sensory seta near apex. Interantennal space less than length of apical segment. Eyes absent. Rostrum small, average length about 58μ, average width 40μ; rostral loop extending to insertion of second pair of legs. Cephalic plate irregular in shape, about 32μ long, wider posteriorly, sometimes with several vacuoles. Dorsal ostioles conspicuous, their rims well sclerotized.

Legs of medium size, length of segments of hind pair: Trochanter, 42; femur, 103; tibia, 77; tarsus, 56; claw, 20; claw digitules slender, acute, reaching about half the length of elongate, moderately stout claws.

With two to six truncate circuli, varying in size and occurring along venter from abdominal segment II to VII. Anal lobes weakly developed, unsclerotized, each lobe area with three to four elongate setae, longest sometimes 82μ in length, four to five shorter auxiliary setae, number of trilocular pores with some adjacent to bases of larger setae. Anal ring about 40μ in diameter, its setae 62μ long, more slender than largest lobe seta; outer part of anal ring with 12–14 narrow, elongate cells, each with elongate spicule; inner part of ring with 6–10 larger, more elongate, and irregular cells lying adjacent to darkened area of semicircular cells. Bitubular cerores of medium size, with elongate, weakly pigmented ducts whose external bases are surrounded by oval-shaped sclerotized collar, occurring dorsally, 1 on head, 5 on thorax, 14 on abdomen along middorsal line and submarginally. Multilocular disk pores confined to venter, some 40–48 present on abdominal segments VII–IX. Tubular ducts unusually large, about 6μ long, rather flask-shaped, their diameter exceeding that of trilocular pore, scattered over entire derm. Trilocular pores fairly evenly distributed except on thorax and between abdominal segments. Body setae slender, short to medium in length, distributed in same manner as pores.

Holotype.—Retalhuleu, Guatemala, 16-V-45, E. J. Hambleton. **Paratypes.**—Three, taken with holotype. USNM.

Host Plants.—*Coffea arabica*, unidentified Compositae.

Distribution.—Costa Rica, El Salvador, Guatemala.

Costa Rica: Coto, 13–IV, 20–V–57, E. B. Dixon.

El Salvador: Two mi S. Quetzaltepeque, 17–VII–61, M. E. Irwin.

Guatemala: Retalhuleu, 16–V–45, E. J. Hambleton. San Rafael Pie de la Cuesta, Departamento de San Marcos, December 1963, N. Jesus Escobar.

Discussion.—*R. campestris* is one of the few species with multiple circuli and five-segmented antennae. Perhaps it is more closely allied to *kondonis* than to any other species. It is distinguished from the latter by its smaller size, shorter and less abundant body setae, fewer multilocular disk pores, and particularly by its poorly developed anal lobes, each with 3–4 elongate setae instead of 8–10 as in *kondonis*.

Rhizoecus chilensis, new species

(Figs. 89–93)

Rhizoecus leucosomus (Cockerell): Gonzalez and Charlin, 1968: 112 (misidentification).

Adult Female.—Elongate ovate, narrower toward head. Length, 1.07–1.43 mm; width, 0.29–0.58 mm. Antennae six-segmented, closely spaced, average length of segments: I, 34; II, 18; III, 28; IV, 15; V, 18; VI, 44; apical seg-

ment not twice as long as wide, with three slender, falcate sensory setae and one shorter, spinelike sensory seta; segment V with one short, slender sensory seta. Interantennal space less than width of segment I. Eyes rather inconspicuous, weakly pigmented, slightly protuberant. Rostrum of medium size, 68μ long, 53μ wide; rostral loop extending to insertion of second pair of legs. Cephalic plate irregularly elongate, reaching base of antennae, about 50μ long, 33μ wide. Dorsal ostioles inconspicuous, their rims thinly sclerotized.

Legs of medium size. Average length of segments of hind pair: Trochanter, 38; femur, 91; tibia, 79; tarsus, 50; claw, 23; claw digitules long, slender, dilated at their tips, extending to or slightly beyond moderately elongate, curved, acute claws.

With one conical circulus about 22μ wide at base. Anal lobes undeveloped, without sclerotization, each lobe area with three elongate setae, one about 61μ long, slightly longer and stouter than remaining two. Anal ring well developed, structurally distinct, about 68μ wide, its setae approximately 84μ long, much stouter and longer than lobe setae; outer part of anal ring with 26–28 mostly small, narrow, elongate to oval elongate cells; inner part of ring with 12–16 much larger, irregular cells lying adjacent to clouded area of large hemispherical cells. Tritubular cerores medium to small, their ducts narrow, few in number, about 20–23 present, more common dorsally. Multilocular disk pores absent. Tubular ducts short, smaller than trilocular pore, occurring in small numbers on both surfaces. Trilocular pores rather evenly distributed, with clear areas more common ventrally. Body setae mostly short, longer on head, and posteriorly on abdominal segments.

Holotype.—El Granizo, Olume, Valparaiso Province, Chile, 5–IV–61, L. Campos; USNM.
Paratypes.—Three, same data as holotype, one each, IBM, UCD, and USNM.

Host Plant.—Unknown, taken from soil.

Distribution.—Known only from type locality. Three immature females believed to be this species were taken 4 km W. of Cherquenco, Cautín Province, Chile, 26–IV–65, by R. H. Gonzalez.

Discussion.—This new species somewhat resembles *leucosomus* but may be separated from it by its smaller size, narrower body, shape of its rostrum, its longer rostral loop, and more elongate cells of the outer anal ring.

Rhizoecus cyperalis (Hambleton)

(Figs. 94–97)

Morrisonella cyperalis Hambleton, 1946a: 22.
Rhizoecus cyperalis: Ferris, 1953: 438; McKenzie, 1967: 383 (misidentification).

Adult Female.—Broadly ovate. Length, 1.42–1.58 mm; width, 0.84–1.02 mm. Antennae six-segmented, widely spaced, average length of segments: I, 37; II, 21; III, 34; IV, 20; V, 17; VI, 41; apical segment less than twice as long as wide, with three elongate, moderately stout, weakly tapered, falcate sensory setae and one narrower, spinelike sensory seta; segment V with single, short, stout, almost lanceolate sensory seta. Interantennal space about equal to combined length of segments III–VI. Eyes rather prominent, appearing little longer than wide. Rostrum elongate, about 75μ long, 42μ wide; rostral loop not reaching insertion of second pair of legs. Cephalic plate apparently lacking. Dorsal ostioles well developed, their rims thickly sclerotized.

Legs moderately stout, average length of segments of hind pair: Trochanter, 51; femur, 122; tibia, 85; tarsus, 75; claw, 24; claw digitules very short, acute, not reaching middle of weakly curved claws.

Circulus absent. Anal lobes weakly protruding, unsclerotized, each lobe area with one seta approximately 50μ long and two shorter slender setae. Anal ring about 40μ in diameter, its setae 60μ long, as stout as lobe setae; outer part of anal ring with sinuate to oval, elongate cells, their number impossible to determine because of condition of type. Tritubular cerores of 2 sizes, small and medium, their ducts short, stout, at least 20 of medium-sized cerores occurring dorsally and submarginally over body segments, majority surrounded by 1–4 body setae; 4–6 small cerores present ventrally near body margins of posterior abdominal segments. Multilocular disk pores scarce, only five to seven occurring ventrally near vulva. Tubular ducts small, few in

number, observed near body margins on posterior abdominal segments. Trilocular pores moderately abundant, evenly distributed. Body setae short, slender, rather sparse.

Holotype.—Santiago de Maria, El Salvador, 20–VIII–44, E. J. Hambleton. **Paratypes.**—Three taken with holotype. USNM.

Host Plant.—*Cyperus tenerrimus.*

Distribution.—Known only from the type locality.

Discussion.—McKenzie (*1967*) recorded *cyperalis* from *Adiantum* sp., San Mateo County, Calif., 1955. After close examination of the two rather poor specimens, I am convinced that they were misidentified and confused with *pritchardi*, which they closely resemble. Furthermore, *pritchardi* has been taken on the same host, on the same date, and in the same vicinity, and was recorded as such by McKenzie (*1967*).

This Central American species is closely allied to *nemoralis*, *pritchardi*, and *subcyperalis*, resembling all three in body shape, anal ring, and antennae. The presence of one to four body setae in close proximity to most of the larger tritubular cerores, fewer cerores, and more elongate, tapering, falcate sensory setae separate *cyperalis* from *nemoralis*. The latter is larger with fewer anal-lobe setae and more conspicuous body setae. The characters that separate *cyperalis* from *pritchardi* are its tubular ducts, more cerores, and absence of small circular pores.

Rhizoecus disjunctus McKenzie

(Figs. 98–103)

Rhizoecus disjunctus McKenzie, 1967: 385.

Adult Female.—Elongate oval. Length, 0.75–1.43 mm; width, 0.40–0.56 mm. Antennae six-segmented, rather short, stout, clavate, closely spaced, average length of segments: I, 22; II, 13; III, 21; IV, 13; V, 12; VI, 33; apical segment stout, not twice as long as wide, with three long, slender, falcate sensory setae and one spinelike sensory seta near apex; segment V with one much shorter, narrow sensory seta. Interantennal space less than width of segment I. Eyes hemispherical, pigmented. Rostrum of medium size, 53μ long, 40μ wide; rostral loop not reaching insertion of second pair of legs. Cephalic plate longer than wide, narrow toward apex, about 33μ long. Dorsal ostioles not conspicuous, weakly sclerotized.

Legs moderately short, stout, average length of segments of hind pair: Trochanter, 25; femur, 58; tibia, 53; tarsus, 36; claw, 14; claw digitules long, slender, dilated at their tips, extending beyond sharp, apically curved claws.

With one conical circulus, about 12μ wide at base. Anal lobes undeveloped, with small, elongate sclerotized patch between setae, each lobe area with three slender setae, longest about 43μ long, several body setae, usual derm pores and cerores. Anal ring 40μ wide, its setae slender, slightly stouter and longer than lobe setae; outer part of anal ring with 12 sinuate cells, many with spicules; inner part of ring with 10 larger, more irregular cells lying adjacent to circle of dark, rounded cells. Bitubular cerores present, their two ducts often lying parallel or appearing to be partially fused, elongate, conical, about 8μ–9μ long, projecting well above derm, occurring over entire surface but more abundant dorsally across segments and scattered on head. Multilocular disk pores present on both surfaces, 17–28 on venter of posterior abdominal segments, fewer on dorsum in same general area. Tubular ducts about same size as trilocular pores, their rims strongly sclerotized, rather evenly distributed over entire derm. Trilocular pores sparse. Body setae variable in length, not abundant.

Holotype.—Corona (Prado Dam), Calif., 27–XII–64, D. R. and J. F. Miller; UCD. **Paratypes.**—Two taken with holotype, one UCD, one USNM.

Host Plants.—*Encelia* sp.?, *Eriogonum fasciculatum*, *Eriogonum* sp.

Distribution.—California, Mexico.

California: Beaumont, 24–XII–67, D. R. Miller. Corona, 27–XII–64, D. R. and J. F. Miller.

Mexico: Three mi S. Zapotitlan, Puebla, 2–III–72, D. R. Miller and F. D. Parker.

Discussion.—The elongate, conical bitubular cerores of *disjunctus* separate this unique species from any other *Rhizoecus* in the Western Hemisphere. This type of ceroris is similar to the one found in *geniculatus* from East Afri-

ca, first discussed by me (*1946a*). These interesting cerores, referred to by DeLotto (*1957*) and McKenzie (*1967*) as "unitubular pores," are actually bitubular in nature; the two elongate ducts lie almost parallel. The cerores of *disjunctus* differ from those of *geniculatus* by being larger, wider at the surface, and more strongly tapered at their apices.

Rhizoecus distinctus (Hambleton)

(Figs. 104–110)

Morrisonella distincta Hambleton, 1946a: 24.
Rhizoecus distinctus: Ferris, 1953: 440.

Adult Female.—Oval elliptical, broad across middle. Length, 1.28–2.22 mm; width, 0.74–0.81 mm. Antennae six-segmented, strongly geniculate, closely spaced near apex of head, average length of segments: I, 33; II, 22; III, 21; IV, 20; V, 17; VI, 43; segments clothed with long, slender setae, apical segment with three stout, weakly clavate, falcate sensory setae and one narrow, elongate, spinelike sensory seta; segment V with one narrow, elongate, curved sensory seta. Interantennal space less than width of antennal segment I. Eyes small, protuberant, pigmented. Rostrum elongate, 66μ long, 40μ wide; rostral loop reaching near insertion of second pair of legs. Cephalic plate large, more or less triangulate, about 55μ long, with seven to eight slender body setae bordering its periphery. Dorsal ostioles inconspicuous, their rims with little sclerotization.

Legs rather short, stout, average length of segments of hind pair: Trochanter, 36; femur, 76; tibia, 55; tarsus, 44; claw, 25; claw digitules short, setose, less than half the length of claw, latter long, slender, moderately curved beyond middle.

Circulus absent. Anal lobes weakly protruding with heavily sclerotized patch surrounding lobe setae, each lobe area with three elongate setae, longest about 74μ long, and several smaller body setae. Anal ring about 55μ wide, its setae rather short, averaging about 58μ long, shorter and stouter than lobe setae; outer part of anal ring with 10–12 elongate cells, each with 2–5 spicules; inner part of ring with 8 larger, irregular elongate cells lying next to darkened area of 10–12 large subcircular cells. Tritubular cerores large, their ducts stout, 46–54 occurring rather uniformly on both surfaces, 3 on head, 3–7 on each body segment. Multilocular disk pores occurring dorsally and ventrally in irregular rows across segments, but more abundant on venter, scarce on head. Tubular ducts absent. Trilocular pores fairly numerous and evenly distributed. Body setae variable in size and length, evenly distributed, some longer setae on head and across abdominal segments.

Holotype.—Falls Church, Va., 14–XI–45, Floyd Andre. **Paratypes.**—Two, one taken with holotype, one Cabin John Bridge, Md., 27–III–00, T. Pergande. USNM.

Host Plants.—*Andropogon* sp., *Artemisia vulgaris, Aster* sp., *Dactylis glomerata, Lespedeza cuneata, Malus* sp., *Quercus coccinea, Rubus argutus, Solidago* sp., *Tridens flavus, Verbascum thapsus,* unidentified moss.

Distribution.—Maryland, Virginia.

Maryland: Cabin John Bridge, 27–III–00, T. Pergande. Libertytown, 25–VIII–44, Floyd Andre.

Virginia: Falls Church, 20–VIII, 29–X, 19–XI–44, Floyd Andre. Mt. Vernon, 3–XII–44, Floyd Andre. Purcellville, 10–VI–66, 21–V–68, 21, 23–IV–69, 29–X, 5–XII–70, 20–II–71, E. J. Hambleton.

Discussion.—I have collected this species on 10 different host plants near Purcellville, Va. This additional material enabled me to verify the differences between *associatus* and *distinctus*. (See discussion on p. 14.)

Rhizoecus falcifer Künckel d'Herculais

(Figs. 111–117)

Rhizoecus falcifer Künckel d'Herculais, 1878: 163.
Ripersia terrestris Newstead, 1895: 213.
Rhizoecus terrestris (Newstead): Fernald, 1903: 113.
Rhizoecus africanus Brain, 1915: 65.
Rhizoecus decoratus Green, 1926: 177.
Rhizoecus moruliferus Green, 1933: 52; Williams, 1961: 93.
Rhizoecus falcifer: Rau, 1937: 267; Hambleton, 1946a: 53; Ferris, 1953: 444; Williams, 1962: 47; McKenzie, 1967: 389; Hambleton, 1973: 65.

Adult Female.—Elongate oval, rather large. Length, 1.91–4.28 mm; width, 0.59–1.93 mm. Antennae five-segmented, average length of

segments: I, 66; II, 28; III, 51; IV, 41; V, 112; segment I stout, apical segment longest, more than twice as long as wide, with four moderately stout, elongate, tapering, falcate sensory setae and one slender, spinelike sensory seta. Interantennal space about equal to twice length of antennal segment I. Eyes absent. Rostrum 108μ long, 68μ wide; rostral loop reaching about halfway to insertion of second pair of legs. Cephalic plate irregularly quadrate, about 48μ long, usually with two or three vacuoles. Dorsal ostioles prominent, heavily sclerotized, bordered by numerous body setae and trilocular pores.

Legs normal, size in proportion to body length, average length of segments of hind pair: Trochanter, 73; femur, 184; tibia, 141; tarsus, 98; claw, 40; claw digitules short, setose, reaching about half the length of moderately long, stout, curved claws.

Circulus absent. Anal lobes roundly protruding, unsclerotized, each lobe area with six elongate, stout setae, longest about 188μ long, and four to six shorter auxiliary setae. Anal ring relatively small, about 62μ in diameter, its setae long, slender, averaging about 102μ long; outer part of ring with 10–12 irregularly sinuate cells, most with spicule; inner part of ring containing 8 larger, irregular, elongate cells lying adjacent to circle of darkened semicircular cells. Tritubular cerores present in 2 sizes, 175–200 present, larger size occurring dorsally on head, thorax, and across abdominal segments; medium-sized cerores present ventrally, few on head and thorax, more numerous across abdominal segments. Multilocular disk pores present on both surfaces, more abundant ventrally, especially above and below vulva and on posterior abdominal segments, elsewhere scattered; dorsally more common on head and sides of thorax. Tubular ducts fairly numerous, present on all segments dorsally and ventrally, but more common ventrally on posterior abdominal segments. Trilocular pores numerous and evenly distributed. Body setae variable in length, most shorter than 30μ, some about 55μ, some along body margins 100μ long, more abundant and evenly distributed over dorsal surface.

Types.—Location not determined. Probably in Muséum d'Histoire Naturelle, Paris.

Host Plants.—*Agapanthus* sp., *Ajuga* sp., *Anthemis tinctoria, Aquilegia* sp., *Buxus sempervirens, Cestrum* sp., *Chrysanthemum frutescens, Chrysanthemum* sp., *Codiaeum* sp., *Coffea arabica, C. liberica, Cupressus* sp., *Cynodon dactylon, Fragaria* sp., *Gardenia* sp., *Heuchera* sp., *Howeia belmoreana, H. forsteriana, Iris* sp., *Jasminum* sp., *Kalmia* sp., *Lotus* sp., *Lycopersicon esculentum, Ophiopogon* sp., *Pelargonium* sp., *Phoenix roebelenii, Picea abies, Tropaeolum majus, Watsonia* sp., *Zantedeschia aethiopica,* various Gramineae, miscellaneous flowering plants, in soil and leaf mold. This species has also been reported from the following hosts in California, but I have not seen specimens: *Acacia* sp., *Anemone hupehensis* var. *japonica, Aralia* sp., *Carex* sp., *Citrus sinensis, Delphinium* sp., *Erodium moschatum, Escallonia rubra, Hibiscus* sp., *Ligustrum ovalifolium, Matthiola* sp., *Petunia* sp., *Phoenix canariensis, Piper* sp., *Prunus* sp., *Ribes* sp., *Syringa vulgaris, Thymus vulgaris, Veronica* sp., *Vitis* sp.

Distribution.—California, Florida, Missouri, New Jersey, New York, Dutch Guiana, Mexico.

California: Berkeley, 8–VII–44, E. O. Essig; 15–II–59, A. E. Pritchard; 25–IX–59, L. A. Folson; 17–IV–60, Bill Paul. Davis, 24–V–62, F. E. Strong; 6–VIII–63, H. Lange. El Cerrito, 23–II–60, Lora Wiegmann. Fairfax, 5–V–58, W. Erickson. Gardena, 26–V–58, Hener. Healdsburg, 1–II–62, W. R. Michie; 25–III–65, J. Ogawa. La Jolla, 18–V–63, R. A. Lewis. Los Angeles, 9–VI–17, R. S. Woglum; 17–VII–25, L. E. Myers. Modesto, 5–X–56, G. E. Wilhite. Montebello, 16–IV–31, L. S. Jones. Oakland, 19–VII–39, E. O. Essig; 30–IV–52, G. B. Laing; 29–II–59, A. E. Pritchard. Palo Alto, 25–III–41, Duncan. Piedmont, 10–V–59, K. S. Hagen. Rio Vista, 14–IX–64, W. H. Lange. Sacramento, 27–IV, 8–V–63; 30–IX–67, H. L. McKenzie. Salinas, 17–IV, 19–V–62, W. H. Lange and L. Lanini. San Angelmo, 20–VII–59, J. L. Joos. San Jose, 11–I–21, L. R. Cody and E. O. Essig; 15–V–61, G. S. Myers; 13–IV–21, R. D. Hartman; 25–IX–59, W. Allen; 18–X–59, W. Allen. San Rafael, Aug. 1959, R. Hunsinger. Santa Barbara, 31–III–42, J. B. Steinweden and S. Smith. Santa Paula, 14–X–33, E. L. Smith. Santa Rosa, 15–V–61, M. E. Imsdale. Vallejo, 13–VII–44, E. O. Essig. Walnut Grove, 10–XI–

69, Rogers. Watsonville, 19–IV–67, L. R. Gillogly. Whittier, 29–VII–33, Stickney.

Florida: Location unknown, specimens collected from a palm originating in Florida, 20–XI–53, at station in Iowa, W. S. Craig, collector.

Missouri: St. Louis, 13–VI–41, T. E. Birkett.

New Jersey: E. Rutherford, 1936, G. Rau. Summit, 3–I–21, A. I. Bourne and J. G. Macdonald.

New York: Ithaca, October 1940, 21–II–41, W. G. Bodenstein; 13–IX–38, W. E. Heming; 14–X–50, C. Johansen; April 1955, J. Naegle.

Dutch Guiana: Surinam, 1932?, G. Bunzli.

Mexico: Location unknown, taken at quarantine, Nogales, Ariz., 4–III–68, G. Ehni.

Discussion.—Known by the common name "ground mealybug," this species is one of the better known cosmopolitan members of the genus. Although it was described from France and is widely distributed in Europe, it was not discovered in the United States until 1917. Since then it has at times been a troublesome pest.

R. falcifer is the largest species of the genus. It is easily recognized by its five-segmented antennae, the clusters of anal lobe setae, the many tritubular cerores, and lack of circulus. Although considered by some workers to lack tubular ducts, these structures are present in considerable numbers over the entire body surface in mature females. In general appearance, *falcifer* resembles *kondonis*. The presence of small bitubular cerores and circuli in the latter separates the two species immediately.

Rhizoecus favacirculus, new species

(Figs. 118–125)

Adult Female.—Elongate ovate, of medium size. Length, 1.28 mm; width, 0.60 mm. Antennae six-segmented, rather short, widely spaced, average length of segments: I, 33; II, 15; III, 22; IV, 11; V, 11; VI, 33; apical segment cone-shaped, longer than wide, with three short, stout, weakly clavate, falcate sensory setae with tapered apices and one slender, spinelike sensory seta; segment V with one fairly elongate, clavate sensory seta. Interantennal space equal to combined length of segments IV, V, and VI. Eyes prominent, globose, not strongly pigmented. Rostrum of medium size, elongate, 53μ long, 39μ wide; rostral loop extending almost to insertion of second pair of legs. Cephalic plate triangulate, its base about 38μ–44μ wide, with three vacuoles and several body setae. Dorsal ostioles inconspicuous, lightly sclerotized.

Legs small, average length of segments of hind pair: Trochanter, 34; femur, 73; tibia, 68; tarsus, 40; claw, 19; claw digitules long, slender, their tips dilated, reaching to or slightly beyond moderately stout, curved claws.

With one circulus, about 20μ wide at base, its orifice faveolate. Anal lobes undeveloped, each lobe area with small sclerotized patch between elongate setae, latter broken at their bases. Anal ring about 55μ in diameter, its setae averaging about 70μ long; cells of outer part of ring varying in size and shape, irregularly ovate, about one-half of 28 cells with spicules; inner ring cells fewer in number and varying greatly in shape and arrangement, lying next to contiguous ring of large darkened cells. Tritubular cerores of medium size, 48–55 evenly distributed dorsally and ventrally, not more than 4 or 5 to an abdominal segment. Multilocular disk pores absent. Tubular ducts smaller in diameter than trilocular pore, generally distributed over entire derm. Trilocular pores most numerous dorsally, in some areas sparse on venter. Body setae mostly short, moderately sparse.

Holotype.—Coto, Costa Rica, 20–V–57, E. B. Dixon. **Paratype.**—One, taken with holotype. USNM.

Host Plant.—Unknown, specimens taken in soil under *Coffea arabica*.

Distribution.—Known only from type locality.

Discussion.—This species closely resembles *arabicus*, which is also found on coffee roots, but *favacirculus* differs by possessing long claw digitules, shorter antennae, and stouter falcate setae. The smaller legs and shape of the anal ring cells of *favacirculus* also are distinctive.

Rhizoecus floridanus Hambleton

(Figs. 126–132)

Rhizoecus floridanus Hambleton, 1973: 67.

Adult Female.—Broadly ovate, narrower in area of head and thorax. Length, 1.20–1.63 mm;

width, 0.65–0.80 mm. Antennae six-segmented, of medium size, average length of segments: I, 31; II, 19; III, 25; IV, 17; V, 16; VI, 37; apical segment slightly less than twice as long as wide, with three moderately long, stout, falcate sensory setae and one slender, acute sensory seta; penultimate segment with one smaller, rather elongate, weakly clavate sensory seta. Interantennal space equal to about twice length of segment I. Eyes absent. Rostrum relatively short, measuring about 57μ long, 40μ wide; rostral loop extending to or near insertion of second pair of legs. Cephalic plate irregularly triangulate to quadrate, wider posteriorly, about 38μ across its base, with indistinct vacuoles. Dorsal ostioles weakly sclerotized, inconspicuous.

Legs of medium size, average length of segments of hind pair: Trochanter, 37; femur, 81; tibia, 69; tarsus, 51; claw, 22; claw digitules long, their tips dilated, surpassing narrow, elongate, weakly curved claws.

With one conical circulus, variable in size, width at base varying from 21μ to 35μ, its apex finely faveolate. Anal lobes undeveloped, each lobe area with small, narrow sclerotized patch between three elongate setae, longest measuring about 60μ long. Anal ring about 60μ in diameter, its setae considerably longer and stouter than lobe setae, averaging about 87μ long; outer anal-ring cells large, diversiform, 24–33 present, mostly isolated; inner part of anal ring with 14–20 cells of similar size and shape lying adjacent to inner darkened area of semicircular cells. Tritubular cerores small, walls of their individual ducts almost parallel, 36–40 present dorsally and ventrally, most abundant on abdomen and rather evenly distributed elsewhere. Multilocular disk pores absent. Tubular ducts small, widely scattered on both surfaces but absent from dorsal surface of head. Trilocular pores fairly evenly distributed. Body setae mostly short.

Holotype.—Pembroke, Fla., 2-VIII-67, H. G. Schmidt. **Paratypes.**—Many from numerous localities in Florida and from Spaulding County, Ga. Holotype and five paratypes USNM; two paratypes each BM, UCD, UG, VPI; remaining paratypes FSCA.

Host Plants.—*Aechmea chantinii, A. orlandiana, Andropogon virginicus, Anthemis* sp., *Aralia* sp., *Araucaria excelsa, Arecastrum romanzoffianum, Bambusa* sp., *Billbergia* sp., *Buxus* sp., *Calliandra* sp., *Callistemon rigidus, Carissa grandiflora, Carissa* sp., *Chrysalidocarpus lutescens, Citrus mitis, Citrus* sp., *Conocarpus erecta, Cortaderia selloana, Cuphea* sp., *Dieffenbachia* sp., *Distichlis spicata, Dizygotheca elegantissima, Dracaena marginata, Eremochloa ophiuroides, Eugenia* sp., *Gardenia thunbergia, Hoya* sp., *Ilex cornuta* cv. Burfordii, *I. opaca, I. rotunda, I. vomitoria, Ixora* sp., *Jasminum* sp., *Lachnanthes tinctoria, Leucophyllum frutescens, Panicum* sp., *Philodendron selloum, Philoxerus vermicularis, Phoenix canariensis, Pluchea* sp., *Prunus angustifolia, Pyracantha* sp., *Quercus* sp., *Rhododendron* sp., *Sida* sp., *Viburnum suspensum,* undetermined Gramineae, Palmaceae, from rotting wood of dead maple.

Distribution.—Florida, Georgia, Indiana, Maryland.

Florida: Alva, 17–X–72, J. C. Denmark, Apopka, 11, 15–II–71, C. L. Speaker; 14, 19–VI–72, F. L. Ware; 10–XI–72, P. Gibson and W. H. Pierce; 3–VIII–72, J. F. Knauss. Arcadia, 26–II–71, G. P. Lamb. Boynton Beach, 4–I–73, W. H. Pierce. Bradenton, 5–I–71, J. R. McFarlin; 11–I–71, S. L. Poe. Casselberry, 26–XII–63, C. O. Youtsey. Clearwater, 12–II–71, E. W. Miller. Cudjoe Key, 2–I–73, E. J. Hambleton. Dade City, 30–IX–72, 15–XI–72, W. H. Pierce. Delray Beach, 11, 15–II–71, W. E. Wyles and R. A. Long. Eau Gallie, 8–II–71, H. C. Levan. Englewood, 29–VI–71, C. J. Bickner. Fairvilla, 2, 22–II–71, 21–XII–71, F. L. Ware. Flamingo, 18–II–70, E. J. Hambleton. Ft. Meyers, 31–I–73, W. A. Padgett. Gainesville, 19–IV–67, G. W. Dekle; 29–III–67, G. W. Dekle and C. Lyons. Gillette, 23–IV, 23–V–71, C. J. Bickner. Grant, 19–II–71, H. C. Levan. Key West, 1–I–73, E. J. Hambleton. Lakeland, 6–VI–69, J. W. McLeod. Largo, 10, 11–II–71, C. K. Hickman et al. Lockhart, 30–XII–63, 6–I–64, R. J. Griffith. Mango, 19–II–71, E. R. Simmons. Naples, 4–III–71, W. T. Walsh and W. A Padgett. No Name Key, 21–X–72, W. H. Pierce. N. Miami Beach, 18–XII–72, E. J. Hambleton. Oneca, 27–V–71, J. R. McFarlin. Orlando, 20–II–69, F. L. Ware; 10–II–71, W. W. Smith and E. R. Fatic; 21–V–71, F. L. Ware; 26–II–71, D. A. Grady and E. W. Ensign; 31–VII–72, F. L.

Ware. Osprey, 5, 10, 15–II–71, J. R. McFarlin and C. J. Bickner. Palma Sola, 19–X–72, C. J. Bickner. Palmetto, 25–II–71, J. R. McFarlin. Pembroke, 14–IV, 2–VIII–67, H. G. Schmidt. Pinellas Park, 18–II–71, C. K. Hickman. Plant City, 19–II–71, D. A. Vaughn. Plymouth, 29–I–71, W. W. Smith and E. R. Fatic; 19–V–71, H. M. Van Pelt; 12–X–71, H. M. Van Pelt; 19–X–72, P. Gibson. Punta Gorda, 16–V–71, G. P. Lamb. Sarasota, 22–II–71, J. R. McFarlin and C. J. Bickner. Sebastian Inlet, 12–II–71, H. C. Levan. Seffner, 12–II, 17–VIII–71, D. A. Vaughn. Tall Timbers, 12–XII–69, H. H. Tippins. Tampa, 3, 15–II–71, S. A. Fuller and C. W. Hale; 25–VIII–72, C. W. Hale. Terra Ceia, 15, 18–IX–72, J. R. McFarlin. Vineland, 29–XI–72, F. L. Ware. W. Melbourne, 12–II–71, H. C. Levan. W. Palm Beach, 11, 15–II–71, 4–III–71, M. L. Messec. Windermere, 28–XI–73, F. L. Ware. Winter Haven, 11–VIII–68, H. C. Burnett.

Georgia: Spaulding County, 16–V–68, H. H. Tippins.

Indiana: Bluffton, Wells County, 19–XII–72, R. F. Wilkey.

Maryland: Grasonville (Kent Narrows), 24–IX–42, H. S. McConnell.

Discussion.—*R. floridanus* most closely resembles *tropicalis* from Guatemala but is easily recognized by its more elongate, apical antennal segment, more slender falcate setae, and larger and more numerous triangulate to quadrate anal-ring cells.

Rhizoecus globoculus (Hambleton), new combination

(Figs. 133–140)

Morrisonella globocula Hambleton, 1946a: 25.

Adult Female.—Oval elongate, moderately stout. Length, 1.05–1.36 mm; width, 0.60–0.76 mm. Antennae six-segmented, average length of segments: I, 37; II, 22; III, 26; IV, 21; V, 19; VI, 45; apical segment longer than wide, with three medium-sized, gently tapered, falcate sensory setae and one narrow, elongate, spinelike sensory seta; segment V with one narrow, elongate sensory seta. Interantennal space equal to combined length of segments III, IV, and V. Eyes prominent, globular, weakly pigmented, and constricted at their bases. Rostrum of medium size, about 73μ long, 48μ wide; rostral loop extending to or slightly beyond insertion of second pair of legs. Cephalic plate irregular in shape, 30μ–40μ wide, with two or three vacuoles near its center. Dorsal ostioles rather prominent, their rims rather heavily sclerotized.

Legs well developed, average length of segments of hind pair: Trochanter, 50; femur, 115; tibia, 88; tarsus, 64; claw, 28; claw digitules short, setose, not reaching middle of long, narrow, weakly curved claws.

Circulus absent. Anal lobes slightly protruded and weakly sclerotized, each with three slender setae averaging about 50μ long. Anal ring about 47μ in diameter, its structure not clearly defined, ring setae slightly stouter than anal-lobe setae, longer setae at least 58μ long; cellular structure of outer part of ring appearing narrow and elongate, possibly with less than 13 cells; inner part of ring with larger, undifferentiated cells. Tritubular cerores of 2 sizes, 16–18 of large size on dorsum, 6 along each lateral margin, 4–6 along middorsal line; small to medium-sized cerores occurring on venter of abdominal segments VI–VIII. Multilocular disk pores of 6 or 7 loculi confined to venter of posterior abdominal segments in area of vulva, 18–25 present. Medioventral pores on venter, usually occurring in two groups, one on abdominal segment VI with none to five pores, other posterior to it on abdominal segment VII with four to nine pores. Trilocular pores uniformly distributed but not abundant. Body setae rather fine, sparsely distributed.

Holotype.—Non Pareil Estate, Trinidad, British West Indies, 3–III–44, A. H. Strickland. **Paratypes.**—Two taken with holotype; five, Marper Estate, Trinidad, 5–I–44, A. H. Strickland; one, Trinidad, 6–VI–35, E. J. H. Berwick. USNM.

Host Plants—*Coffea arabica, Theobroma cacao.*

Distribution.—Known only from the type locality.

Discussion.—This species runs parallel with *theobromae* in the key to the New World species of *Rhizoecus*. Although both species attack cacao and are rather unique in having medioventral pores, *globoculus* is readily distin-

guished from the former by its large globular eyes, its multilocular disk pores of six or seven loculi, and the more elongate, tapering falcate setae.

Rhizoecus gracilis McKenzie

(Figs. 141–149)

Rhizoecus gracilis McKenzie, 1961: 45; McKenzie, 1967: 392.

Adult Female.—Elongate oval. Length, 0.95–2.07 mm; width, 0.30–0.83 mm. Antennae six-segmented, moderately short, stout, average length of segments: I, 32; II, 18; III, 25; IV, 17; V, 15; VI, 38; apical segment slightly less than twice as long as wide, with three medium-sized, rather slender, falcate sensory setae and one shorter, tapering, spinelike sensory seta; segment V with one much shorter, narrow sensory seta. Interantennal space equal to about width of basal antennal segment. Eyes hemispherical, not strongly pigmented. Rostrum relatively small, 66μ long, 42μ wide; rostral loop extending to about halfway to insertion of second pair of legs. Cephalic plate slightly longer than wide, with two vacuoles and four body setae. Dorsal ostioles not strongly developed, their rims thinly sclerotized and weakly pigmented.

Legs rather small, stout, average length of segments of hind pair: Trochanter, 35; femur, 81; tibia, 72; tarsus, 48; claw, 15; claw digitules long, dilated at their tips, extending beyond short, stout claws.

With one broadly truncated circulus, width across its base about 20μ–28μ, its orifice reticulated. Anal lobes undeveloped, each lobe area with small, elongate sclerotized patch and three elongate setae subequal in length, longest about 51μ long. Anal ring approximately 48μ wide, its setae averaging 58μ long, stouter and somewhat longer than lobe setae; outer part of anal ring with 14–16 sinuate to oval, elongate cells, each with long spicule; inner part of ring with at least 10 large, irregular, elongate cells lying adjacent to well-defined clouded area of semicircular cells. Bitubular cerores small, moderately stout, their ducts about 7μ long, slightly tapered and divaricated, widely distributed dorsally, 5–8 on head, 25–28 on thorax, usually 4–7 spread across each abdominal segment, occasionally observed ventrally near body margins. Multilocular disk pores variable in number, 11–64 located posteriorly on venter from apex to abdominal segment VI, few occurring dorsally on abdomen. Tubular ducts short, stout, readily observed, scattered dorsally and ventrally over most of derm. Trilocular pores evenly distributed except between segments where they are sparse or missing. Body setae short, slender, uniformly distributed.

Holotype.—Cahill Ridge, Calif., 7–V–60, D. W. Price. **Paratypes.**—Several taken with holotype, also from 2 mi W. of Independence, 6–V–60, A. S. Menke and F. D. Parker, and at Susanville, Calif., 17–V–58, R. W. Gerhardt. Holotypes and paratypes UCD; paratypes CDA, USNM.

Host Plants.—*Achillea millefolium, Artemisia californica, Artemisia* sp., *A. tridentata, Atriplex* sp., *Brickellia* sp., *Chrysothamnus viscidiflorus, Eriogonum heracleoides, Eriophyllum confertiflorum, Franseria chamissonis, Grindelia camporum, Gutierrezia* sp., *Haplopappus canus, H. spinulosus* ?, undetermined Cactaceae, Chenapodiaceae, Compositae, Gramineae, Leguminoseae, Loranthaceae, in soil, under rocks, beneath chaparral.

Distribution.—Arizona, California, Colorado, Idaho, Montana, New Mexico, Oklahoma, Oregon, Texas, Virginia, Mexico.

Arizona: Bisbee, 2–VIII–66, D. R. Miller. Five mi NE. Douglas, 2–VIII–66, D. R. Miller.

California: Barrego Springs, 27–I–65, D. R. Miller. Cahill Ridge, 7–V–60, D. W. Price. Coches Prietos, Santa Cruz Island, 18–VI–67, 10–V–68, D. R. Miller. Two mi W. of Independence, 6–V–60, A. S. Menke and F. D. Parker. Fifteen mi N. of Kramer Junction, 28–XII–64, D. R. and J. F. Miller. Two mi N. of Lompoc, 27–VI–66, D. R. Miller. Merced, 18–I–67, T. R. Haig. Monitor Pass, 9–VIII–64, D. R. Miller. Ten mi N. of Pescadero, 8–II–64, D. R. Miller and J. A. Froebe. Susanville, 17–V–58, W. Gerhardt. Trabuco Canyon, 28–III–64, D. R. Miller and J. A. Froebe. Valley Center, 27–III–64, D. R. Miller and J. A. Froebe. Warner Springs, 26–I–65, D. R. Miller. W. Patterson, 27–IV–66, D. R. Miller.

Colorado: Holly, 29–VI–70, D. R. Miller. Lamar, 30–VI–70, D. R. Miller.

Idaho: Craters of the Moon, 8–VIII–67, D. R. Miller and D. S. Horning. Five mi E. of Montpelier, 3–VIII–67, D. R. Miller and D. S. Horning. Twenty mi N. of Spencer, 5–VIII–67, D. R. Miller and D. S. Horning.

Montana: Boyes, 11–VIII–70, D. R. Miller. Nine mi SE. Livingston, 28–VIII–64, D. R. and J. F. Miller.

New Mexico: Carrizozo, 6–VIII–66, D. R. Miller. Five mi NW. Cedarvalle, 6–VIII–66, D. R. Miller. Three mi S. Oscuro, 5–VIII–66, D. R. Miller. Seven mi W. of Silver City, 6–IX–68, D. R. Miller and J. E. Lauck.

Oklahoma: N. of Boise City, 30–VI–70, D. R. Miller.

Oregon: Bandon, 6–VIII–68, D. R. Miller and R. F. Denno. Twelve mi SW. of Plush, 3–VIII–68, D. R. Miller and R. F. Denno. Ten mi W. of Vale, 4–VIII–70, D. R. Miller.

Texas: Dumas, 1–VII–70, D. R. Miller.

Virginia: Mountain Lake, 24–X–70, D. R. Miller.

Mexico: Apizaco, Tlaxcala, 16–VII–67, D. R. Miller and J. Villanueva B. Jalapa, Vera Cruz, 16–VII–67, D. R. Miller and J. Villanueva B. Fifteen km SW. of Miraflores, Vera Cruz, 13–VII–67, D. R. Miller and J. Villanueva B. Seven km N. of Perote, Vera Cruz, 28–II–72, and 7 km SW. of Perote, 29–II–72, D. R. Miller and F. D. Parker. Texcoco, 12–VII–67, D. R. Miller and J. Villanueva B.

Discussion.—Since its discovery in California in 1960, *gracilis* has been collected in nine additional States and Mexico owing largely to the intensive and productive collecting by D. R. Miller and his associates. Except for seven locality records previously reported by McKenzie (*1967*) for California, the distribution records listed here are new. With its recent discovery in Virginia, *gracilis* appears to be the most widely distributed indigenous species in the United States.

The species most closely resembling *gracilis* is *totonicapanus* from Guatemala. The falcate sensory setae of *gracilis* are slender and taper apically, whereas those of *totonicapanus* are somewhat stouter and weakly clavate distally. In *gracilis* the rostrum is slightly longer and there appear to be fewer bitubular cerores than in *totonicapanus*.

Rhizoecus graminis (Hambleton)

(Figs. 150–154)

Morrisonella graminis Hambleton, 1946a: 28.
Rhizoecus graminis: Ferris, 1953: 446; McKenzie, 1967: 394.

Adult Female.—Oval elongate. Length, 1.26–1.85 mm; width, 0.54–0.76 mm. Antennae six-segmented, elongate, segments I and VI rather stout, length of segments as follows: I, 57; II, 26; III, 37; IV, 27; V, 28; VI, 70; apical segment robust, about twice as long as wide, with three moderately stout, falcate sensory setae, tapering gradually apically, and one much narrower, spinelike sensory seta; segment V with one much shorter, stout, clavate sensory seta narrow at its base. Eyes rather prominent, protuberant, lightly pigmented. Rostrum elongate, 96μ long, 61μ wide; rostral loop reaching insertion of second pair of legs. Cephalic plate relatively small, with two vacuoles and two body setae. Dorsal ostioles conspicuous, their rims heavily sclerotized and surrounded by numerous body setae and pores.

Legs well developed, elongate, average length of segments of hind pair: Trochanter, 63; femur, 135; tibia, 122; tarsus, 73; claw, 28; claw digitules very short, setose, less than half the length of stout, elongate, curved claws.

Without circulus. Anal lobes weakly protruded, partially sclerotized, each lobe area with three elongate setae, longest about 88μ long, and several shorter body setae; trilocular pores crowded at base of larger setae. Anal ring about 51μ in diameter, its structure not clearly visible, its setae averaging about 67μ long, slightly narrower and much shorter than longer lobe setae; outer part of anal ring apparently with 14–16 small, elongate cells; inner part of ring with cells larger and less numerous. Tritubular cerores of 2 sizes present, 20 of larger size occurring dorsally, 6 along middorsal line from head to abdominal segment VI, 7 along each body margin or submarginally; small tritubular cerores with about 25 present ventrally, 4 on thorax, 21 distributed across abdominal segments IV–IX. Multilocular disk pores numerous, present dorsally and ventrally, more profuse ventrally in bands across abdominal segments. Tubular ducts small, their collars sclerotized, slightly larger in diameter than tri-

locular pore, commonly observed ventrally on posterior abdominal segments. Mushroom bodies present dorsally and ventrally. Trilocular pores apparently with tiny prongs, rather uniformly distributed except scarce on thorax. Body setae variable in size, distributed in same manner as trilocular pores.

Holotype.—Oakland, Calif., 29–I–38, E. O. Essig. **Paratypes.**—Twelve taken with holotype, 7 on one slide with holotype, 5 on 2 additional slides. USNM.

Host Plant.—*Agrostis* sp.

Distribution.—California. The type locality, and Colma, 12–XII–63, C. S. Koehler.

Discussion.—Although *R. graminis* keys to the same couplet as *latus* from Ecuador, the two species are easily separated. The antennae and leg segments of *graminis* are much larger, the eyes less protuberant, and the number of multilocular disk pores is greater than in *latus*.

Rhizoecus insularis, new species

(Figs. 155–158)

Adult Female.—Elongate oval. Length, 1.24 mm; width, 0.65 mm. Antennae six-segmented, of average size, segments measuring as follows: I, 22; II, 17; III, 25; IV, 13; V, 14; VI, 33; apical segment less than twice as long as wide, with three moderately stout, elongate, falcate sensory setae and one slender, spinelike sensory seta; segment V with one shorter, narrow sensory seta. Interantennal space equal to combined length of segments I and II. Eyes semicircular, rather prominent. Rostrum small, 47μ long, 44μ wide; rostral loop extending to about insertion of second pair of legs. Cephalic plate not distinguishable. Dorsal ostioles inconspicuous, their rims very thinly sclerotized.

Legs short, segments of hind legs measuring as follows: Trochanter, 35; femur, 72; tibia, 68; tarsus, 46; hind claw missing; claw digitules long, slender, their tips dilated, reaching slightly beyond claws.

With one conical, weakly faveolate circulus measuring about 16μ at its base. Anal lobes slightly or not developed, each lobe area with three small, delicate setae, longest about 60μ long. Anal ring clearly defined, about 55μ wide, its setae averaging approximately 66μ long, much stouter than lobe setae; outer part of anal ring with 28 large, subquadrate to triangulate cells, mostly touching end to end; inner part of ring with 10–12 irregular, more elongate cells lying adjacent to darkened area of cellular structure. Tritubular cerores small, their ducts narrow, elongate, projecting more than one-half their length above body surface, 55–60 of them occurring on both surfaces, widely distributed, as many as 6 per abdominal segment. Multilocular disk pores absent. Tubular ducts small, few in number, observed more readily along body margins. Trilocular pores moderately abundant, scattered. Body setae short, inconspicuous.

Holotype.—Darwin Research Station, Galapagos Islands, 30–I–64, R. O. Schuster; UCD.

Host Plant.—*Hippomane mancinella.*

Distribution.—Known only from the type locality.

Discussion.—At least three species of *Rhizoecus* are now known from the Galapagos Islands: *latus, insularis,* and a third apparently undescribed species of which only an immature female has been seen. The large cellular structure of the anal ring, the small rostrum, and number and size of the tritubular cerores are distinguishing features of *insularis*.

Rhizoecus kondonis Kuwana

(Figs. 159–166)

Rhizoecus kondonis Kuwana, 1923: 55; Hambleton, 1946a: 56; Ferris, 1953: 448; McKenzie, 1960b: 749; McKenzie, 1967: 394; Kuwai and Takagi, 1971: 177.

Rhizoecus spinosus McKenzie, 1960b: 753; McKenzie, 1967: 404. NEW SYNONYMY.

Adult Female.—Elongate oval. Length, 1.58–2.24 mm; width, 0.62–0.92 mm. Antenna five-segmented, moderately stout, placed near apex of head, segments with following measurements: I, 55; II, 34; III, 38; IV, 25; V, 95; apical segment almost three times as long as wide, segment I very stout, with four relatively stout, short, weakly tapered, falcate sensory setae and one narrow, elongate, spinelike seta gently curved. Interantennal space less than width of segment I. Eyes absent. Rostrum averaging about 75μ long, 53μ wide; rostral loop reaching

almost to insertion of second pair of legs. Cephalic plate occasionally obscure, wider than long, triangulate, with 2 small vacuoles near its center and 8–10 short setae along or near its border. Dorsal ostioles well developed, strongly sclerotized, and surrounded by numerous setae and pores.

Legs large, well developed, average length of segments of hind pair: Trochanter, 59; femur, 137; tibia, 109; tarsus, 81; claw, 34; claw digitules very short, acute, less than half the length of slender, curved claws.

Usually with two truncate circuli, smaller one on abdominal segment III, one on segment IV averaging about 29μ in diameter, both circuli with thinly sclerotized orifices and some reticulation. Anal lobes well developed, roundly protruding, apparently unsclerotized, each with cluster of 8–10 elongate setae, varying in length, longest about 98μ long. Anal ring about 54μ in diameter, well differentiated, its setae averaging about 60μ long, more slender than largest lobe setae; outer part of anal ring with 18–20 fairly uniform, oval, elongate cells, each with spicule; inner part of ring made up of about 10 larger, more elongate, and irregular cells, clouded area with little or no visible design. Bitubular cerores small, each with 2 ducts arising from sclerotized cone with oval-shaped base, 25–30 uniformly distributed on dorsum. Multilocular disk pores concentrated ventrally in area of vulva and from segment VII posteriorly to apex, absent elsewhere, 65–106 present. Tubular ducts present on both surfaces but most common on abdomen, their diameter about size of trilocular pore. Trilocular pores uniformly distributed over most of derm. Body setae numerous, variable in length, some measuring 100μ long.

Types.—According to S. Takagi (personal communication), Kuwana's types of *kondonis* were probably lost in a fire following an earthquake in Tokyo, Sept. 1, 1923. Two topotypes taken on roots of orange, Wakayama, Japan, in November 1926 and identified by Kuwana, formerly a part of the Stickney collection, are in the USNM. The types of *R. spinosus* are in UCD.

Host Plants.—*Carex* sp.?, *Celtis occidentalis, Citrus* sp., *Coffea arabica, Fragaria* sp., *Ligustrum* sp., *Medicago sativa, Nerium* sp., *Pelargonium inquinans, Portulaca grandiflora, Prunus* sp., *Rosa* sp., *Rumex* sp., *Scabiosa* sp., *Stellaria media, Watsonia* sp., leaf mold, decaying log.

Distribution.—California, Guatemala.

California: Berkeley, 27–X–28, E. O. Essig. Butte County, 15–X–62, M. Morse. Clarksburg, 23–XI–60, V. E. Berton. Davis, 12–XI–58, L. M. Smith; 9–XI–60, D. W. Price and R. O. Schuster; 15–X–65, Mrs. Rose. Two mi N. of Dixon, 11–V–66, A. G. Gentile. Healdsburg, 12–I–62, P. F. Wright. Hopland, 2–VIII–67, T. Erickson. Knight's Landing, 24–IV–59, F. C. Raney. Menlo Park, 11–III–21, G. F. Ferris. Mix Canyon, 25–VIII–60, R. O. Schuster. Placer County between Wheatland and Newcastle, 26–IX–62, V. Marble. Placerville, 11–II–44, M. Austin. Sacramento, 8–V–63, H. L. McKenzie. St. Helena, 12 mi N. of city, 8–IV–61, F. C. Raney. San Jose, 10–XII–58, A. E. Pritchard. San Leandro, 9–VI–59, A. E. Pritchard. Santa Monica, 18–IV–40, in quarantine from St. Helena. Santa Rosa, 7–XI–58, B. Houston. Stockton, 3–XI–70, J. Gianelli. Yuba City, 26–V–59, K. Uriu. Two mi S. of Yuba City, 23–III–62, L. M. Smith.

Guatemala: San Marcos, San Marcos Province, 4–XI–63, N. Escobar.

Discussion.—The distribution of *kondonis* in the United States is restricted to California, where it has become a pest of considerable importance (McKenzie, *1960b*). Its presence in Guatemala may indicate a wider distribution in the hemisphere than records signify.

Kuwai and Takagi (*1971*) have called attention to some discrepancies between Japanese specimens of *kondonis* and the descriptions and figures given by Ferris (*1953*) and McKenzie (*1967*). Ferris' indequate illustration and diagnosis of *kondonis* apparently mislead McKenzie when he (*1960b*) prepared the description of *spinosus*. No mention was made of its similarity to the Japanese species until 1967.

I have carefully checked the types and nine additional specimens labeled *spinosus* and find no difference between them and those labeled *kondonis*. The type specimen of *spinosus* has what appears to be a poorly defined and weakly sclerotized circulus on segment III in addition to the normal larger one on segment IV. Occasionally only a single circulus may be present in

species normally having multiple circuli. Of the 95 specimens of *kondonis* studied, 35 were immature females, all with a single circulus. One specimen identified by McKenzie as *spinosus* has two circuli, the normal number for *kondonis*. Since there appear to be no consistent differences between the two, I consider them the same, and *spinosus* thus becomes a junior synonym of *kondonis*.

The roundly protruding anal lobes beset with numerous elongate setae, the normal presence of two circuli in the adult female, the five-segmented antennae, and bitubular cerores are important distinguishing characters of *kondonis*.

Rhizoecus latus (Hambleton), new combination

(Figs. 167–174)

Morrisonella lata Hambleton, 1946a: 30.

Adult Female.—Broadly ovate. Length, 1.35–1.61 mm; width, 0.82–1.07 mm. Antennae six-segmented, widely spaced near apex of head, segments measuring as follows: I, 38; II, 20; III, 25; IV, 20; V, 17; VI, 45; apical segment tapered, with three moderately stout, falcate sensory setae and one elongate, slender, acute sensory seta; segment V with one elongate, slender sensory seta. Interantennal space equal to combined length of four distal antennal segments. Eyes prominent, protuberant, pigmented, slightly longer than wide. Rostrum of medium size, 75μ long, 48μ wide; rostral loop extending to beyond halfway to insertion of second pair of legs. Cephalic plate small, triangulate to quadrate, with indistinct vacuoles and body seta on each laterocephalic margin. Dorsal ostioles conspicuous, their rims thickly sclerotized.

Legs of normal size, average size of segments of hind pair: Trochanter, 50; femur, 107; tibia, 80; tarsus, 64; claw, 26; claw digitules short, setose, reaching almost to middle of fairly stout, weakly curved claws.

Circulus absent. Anal lobes slightly prominent, each sclerotized and with one long and two shorter elongate setae, longest about 80μ–85μ long, and several auxiliary setae. Anal ring rather small, about 41μ in diameter, its setae about 60μ long, slightly stouter and longer than shorter lobe setae; outer part of anal ring with 10–12 elongate, oval cells, each with spicule; inner part of ring with irregularly elongate, somewhat larger cells lying adjacent to concentric ring of large, ovate, darkened cells. Tritubular cerores of 2 sizes, larger size confined to dorsum, 1 on head, 5 on thorax, 5 on abdomen; 10–12 medium-sized cerores, most occurring on venter of posterior abdominal segments. Multilocular disk pores present on both surfaces, at least 50 observed ventrally from apex of abdomen to abdominal segment VII, elsewhere very few scattered widely on head, thorax, and abdomen. Tubular ducts present, their collars slightly larger in diameter than a trilocular pore, most common ventrally but also present dorsally. Trilocular pores sparse, uniformly distributed. Body setae sparse, mostly short but few longer ones on head and along body margins.

Holotype.—Pichilingue, Ecuador, 2–X–44, E. J. Hambleton. **Paratypes.**—Five taken with holotype. USNM.

Host Plants.—*Hippomane mancinella,* undetermined Gramineae.

Distribution.—Ecuador, Galapagos Islands.

Ecuador: From the type locality.

Galapagos Islands: Darwin Research Station, Santa Cruz Island, 25–I, 30–I–64, R. O. Schuster.

Discussion.—Sixteen specimens from an undetermined host taken in the Galapagos Islands answer the description of *latus* but differ in the following respects: The largest adult female measures 1.43 mm, whereas most specimens consist of newly emerged females with nondistended bodies that measure less than 1.00 mm in length; the rostrum is shorter, more rounded at its apex; the sensory seta on antennal segment V is weakly clavate apically. In another collection from the same locality, taken on *Hippomane mancinella,* two specimens of *latus* were taken with the species *insularis.*

Rhizoecus leucosomus (Cockerell)

(Figs. 175–181)

Ripersiella leucosoma Cockerell, 1901: 165.

Ripersiella leucosoma: Fernald, 1903: 115; Bueker, 1931: 151; Hambleton, 1946a: 66.

Rhizoecus leucosomus: Ferris, 1953: 450; McKenzie, 1967: 398.

Rhizoecus cacticans (Hambleton): McKenzie, 1967: 400 (misidentification in part).

Adult Female.—Oval elongate, moderately stout. Length, 1.60–2.88 mm; width, 0.70–1.55 mm. Antennae six-segmented, rather widely spaced; segments in following proportions: I, 34; II, 24; III, 34; IV, 18; V, 20; VI, 53; apical segment seldom twice as long as wide, with three elongate, medium-sized, falcate sensory setae and one narrow, spinelike sensory seta; segment V with one shorter but elongate sensory seta. Interantennal space equal to combined length of two apical segments. Eyes comparatively small, not strongly pigmented, slightly protuberant. Rostrum short, stout, averaging about 74μ long, 64μ wide; rostral loop seldom reaching halfway to insertion of second pair of legs. Cephalic plate fairly large, longer than wide, about 45μ long, with two large vacuoles, and usually bordered by three or four setae. Dorsal ostioles plainly evident, weakly sclerotized.

Legs of average size, segments of hind pair measuring as follows: Trochanter, 48; femur, 122; tibia, 104; tarsus, 63; claw, 25; claw digitules elongate, dilated apically, extending beyond moderately stout, curved claws.

With one truncated, cone-shaped circulus. Anal lobes undeveloped, each lobe area with one elongate seta about 76μ long and two shorter elongate setae. Anal ring large, about 64μ in diameter, its structure distinct, its setae stouter than lobe setae, about 89μ long; outer part of anal ring with 23–32 mostly oval, elongate cells and some distinctly shorter, irregularly rounded cells, many lying end to end but not always touching; inner part of ring with 16–20 larger, irregularly elongate cells lying next to clouded area of semicircular cells. Tritubular cerores small, 5 on head, 10–13 on thorax, 18–20 on abdomen, more prevalent on dorsum, few submarginally on venter. Multilocular disk pores absent. Tubular ducts smaller than trilocular pores, present on both surfaces. Trilocular pores uniformly distributed. Body setae short, inconspicuous.

Lectotype.—Las Vegas, N. Mex., 11-IV-01, W. P. Cockerell. **Paralectotypes.**—Five with lectotype on one slide. USNM.

Host Plants.—*Bahia dissecta, Cyperus esculentus, Escoboria tuberculosa, Mammillaria* sp., *Nerium oleander, Phleum pratense, Poa* sp., *Psoralea tenuiflora, Sempervivum* sp., *Sorghum halepense,* unidentified Gramineae, under stones with ants.

Distribution.—Arizona, California, Colorado, New Mexico, Ohio, Texas, Virginia, Washington, D.C., Mexico.

Arizona: 19 mi E. McNary, 8,500 ft, 18-VII-40, L. P. Wehrle. Williams, 1-IX-68, D. R. Miller and J. E. Lauck.

California: Calexico, 30-III-72, R. A. Flock and D. Conn. Norco, 4-X-65, N. W. Getz and J. H. Preston. Sacramento, 22-IX-65, S. Scribner. San Clemente, 22-X-65, A. Johnson.

Colorado: Boulder, 13-VIII-23, R. Shotwell.

New Mexico: Las Vegas, 11-IV-01, W. P. Cockerell.

Ohio: In quarantine at Washington, D.C., 4-XII-22, W. B. Wood.

Texas: Corpus Christi, 4-VIII-71, S. Nakahara.

Virginia: Chincoteague, 17-VIII-71, D. R. Miller. Narrows Marina, Seashore State Park, 9-V-71, D. R. Miller and S. Nakahara.

Washington, D.C., 1-III-27, H. Y. Gouldman.

Mexico: In quarantine at Nogales, Ariz., 9-IX-67, J. M. Kaiser. Seven mi N. Perote, Vera Cruz, 28-II-72, D. R. Miller and F. D. Parker.

Discussion.—The type material of *leucosomus,* consisting of six specimens mounted on one slide, was remounted in February 1931 and again in May 1944. Since a type was not designated by Cockerell, I hereby designate specimen No. 1 at the extreme left on the type slide as the lectotype. The midlegs and hind legs are missing, but otherwise the lectotype is in good condition. The five paralectotypes are also in fair condition except some missing appendages and lobe setae.

Until recently *leucosomus* has been known only in the Western United States. It has been confused with *cacticans, floridanus,* and *nakaharai.* The San Clemente record by McKenzie *(1967)* for California is correct, but the remaining ones refer to *cacticans* and *nakaharai.*

The similarity of *leucosomus* to *cacticans* and what may be intermediate forms of these species sometimes makes their identification

difficult. In most specimens they may be readily separated by comparing details of the antennae, rostrum, and anal ring.

Rhizoecus macgregori, new species

(Figs. 182–191)

Adult Female.—Oval elongate, moderately stout. Length, 1.44–1.95 mm; width, 0.65–1.06 mm. Antennae six-segmented, average length of segments: I, 44; II, 26; III, 40; IV, 23; V, 26; VI, 56; apical segment almost twice as long as wide, with three rather stout, tapering, falcate sensory setae and one elongate, spinelike sensory seta; segment V with short, much smaller sensory seta. Interantennal space equal to combined length of segments II and III. Eyes small, pigmented, not strongly protuberant. Rostrum fairly stout, elongate, about 85μ long, 56μ wide; rostral loop reaching more than halfway to insertion of second pair of legs. Cephalic plate irregularly triangulate, approximately 45μ–50μ wide, with three or four vacuoles and bordered by several body setae. Dorsal ostioles well developed, their rims narrow, sclerotized.

Legs rather elongate, average length of segments of hind pair: Trochanter, 48; femur, 129; tibia, 115; tarsus, 69; claw, 24; claw digitules elongate, dilated apically, extending beyond basally stout, curved claws.

With one prominent, strongly sclerotized subconical circulus, measuring about 39μ at its base, its orifice 20μ wide, finely reticulated. Anal lobes little or not protruding; each lobe area with small sclerotized patch between three elongate setae, longest about 88μ long, and few short body setae and trilocular pores. Anal ring large, about 81μ in diameter, its setae somewhat stouter and longer than lobe setae; outer part of anal ring containing 42–45 small oval cells, in places forming double row; inner part of ring with about 20 larger, more irregular cells. Tritubular cerores small, 40–60 submarginally and across body segments dorsally and ventrally. Multilocular disk pores absent. Tubular ducts conspicuous, varying in diameter from size of trilocular pore to that of tritubular ceroris, stout, strongly sclerotized, widely distributed over entire derm. Minute mushroom bodies less than one-half diameter of trilocular pore, scattered widely over body surface. Trilocular pores fairly abundant, more common dorsally. Few minute, simple circular pores observed ventrally across midabdominal segments. Body setae short, rather sparse.

Holotype.—Apatzingan, Michoacan, Mexico, 19–XI–65, Raúl MacGregor; USNM. **Paratypes.**—Two, taken with holotype; IBM.

Host Plant.—*Gossypium hirsutum.*

Distribution.—Known only from type locality.

Discussion.—The sclerotized anal lobes, size and abundance of the conspicuous tubular ducts, and the presence of minute mushroomlike tubular ducts and circular pores distinguish this cotton-inhabiting species from all other members of the genus.

It is with pleasure that I dedicate this species to Dr. Raúl MacGregor L. of the Instituto de Biologia, Universidad Nacional, Mexico, D.F.

Rhizoecus maritimus (Cockerell)

(Figs. 192–196)

Ripersia maritima Cockerell, 1894: 42.
Ripersiella maritima: Cockerell, 1899: 278; Fernald, 1903: 115.
Morrisonella maritima: Hambleton, 1946a: 31.
Rhizoecus maritimus: Ferris, 1953: 452; Hambleton, 1973: 68.

Adult Female.—Elongate oval. Length, 1.17–2.51 mm; width, 0.34–1.33 mm. Antennae six-segmented, average length of segments: I, 40; II, 25; III, 36; IV, 17; V, 21; VI, 55; apical segment almost twice as long as wide, with three medium-sized, tapering, falcate sensory setae and one acute, spinelike sensory seta; segment V with one much smaller, weakly curved sensory seta. Interantennal space about equal to combined length of segments V and VI. Eyes prominent, rather globose, pigmented. Rostrum stout, length about 84μ, width, 73μ; rostral loop usually short but sometimes reaching insertion of second pair of legs. Cephalic plate approximately 50μ long, triangulate or quadrate, with two or three vacuoles and six or more small body setae. Dorsal ostioles fairly well developed, their rims weakly pigmented, lightly sclerotized.

Legs moderately stout, average length of segments of hind pair: Trochanter, 55; femur, 120; tibia, 109; tarsus, 73; claw, 39; claw digitules slender, setose, varying in length but usually about half the length of narrow, elongate, weakly curved claws.

With one large truncate circulus, its broad, sclerotized base about 45μ in width. Anal lobes undeveloped, unsclerotized, each lobe area with three elongate setae, longest about 90μ long, remaining two slightly shorter. Anal ring large, about 87μ in diameter, its structure clearly defined, ring setae each about 85μ–90μ long, about same thickness as longer lobe setae; outer anal ring composed of 36–40 rather small, oval, or irregularly polygonal cells, some not touching, some with short spicules; cells of inner part of ring much larger, 26–28 present, more elongate, rectangular, mostly touching end to end, sometimes forming double row and lying adjacent to clouded area of large semicircular cells. Tritubular cerores small, their ducts slightly tapered, occurring on both surfaces, but more common dorsally, 4–5 on head, 10–12 on thorax, 18–20 on abdomen. Multilocular disk pores absent. Tubular ducts small, numerous, distributed over entire derm. Trilocular pores well distributed but sometimes sparse in areas across segments. Body setae variable in size and length, longer setae on head, thorax, and along body margins.

Lectotype.—Sea Cliff, N.Y., 7–V–94, Nathan Banks, mounted on one slide with five paralectotypes. **Paralectotypes.**—Five additional specimens mounted on two slides. USNM.

Host Plants.—*Faucaria tigrina, Iva frutescens* var. *oraria, Rhizophora mangle, Spartina alterniflora, S. patens.*

Distribution.—Florida, Massachusetts, New Jersey, New York.

Florida: Bailey's Bluff, 7–III, 3–VIII–71, G. T. Williams. Cedar Key, 19–VII–70, G. W. Dekle. Tampa, 17–II–71, E. R. Simmons.

Massachusetts: Cape Cod, July 1968, W. J. Wall.

New Jersey: Greenwich, 1–XI–44, G. Rau.

New York: Hampton Bays, Long Island, 14–V–57; North Sea, Long Island, 19–V–57, John Vack.

Discussion.—Since Cockerell (*1894*) did not designate a holotype in his original description, I hereby designate the second specimen from the right on slide No. 1 as the lectotype.

R. maritimus may be readily distinguished from its closest allies by its long, slender claws, stout rostrum, and claw digitules that are about half as long as the claws.

Rhizoecus mayanus (Hambleton)

(Figs. 197–204)

Morrisonella mayana Hambleton, 1946a: 32.
Rhizoecus mayanus: Ferris, 1953: 454.

Adult Female.—Oval elongate, moderately stout. Length, 0.89–2.00 mm; width, 0.41–1.04 mm. Antennae six-segmented, widely spaced, average length of segments: I, 38; II, 20; III, 28; IV, 22; V, 18; VI, 46; apical segment cone-shaped, with three moderately stout, weakly tapering, falcate sensory setae and one slender, spinelike sensory seta; segment V with one narrow, elongate sensory seta. Interantennal space about equal to combined length of antennal segments I–IV. Eyes small, protuberant, lightly pigmented. Rostrum elongate, 73μ long, 48μ wide; rostral loop extending halfway or more to insertion of second pair of legs. Cephalic plate broader than long, about 30μ long, 48μ wide, with body seta on each laterocephalic margin. Dorsal ostioles moderately conspicuous, their rims heavily sclerotized, surrounded with numerous pores and body setae.

Legs of medium size, average length of segments of hind pair: Trochanter, 44; femur, 99; tibia, 79; tarsus, 66; claw, 27; claw digitules short, setose, reaching about half the length of fairly stout, weakly curved claws.

Circulus absent. Anal lobes weakly protruding, with small, irregular sclerotized area at base of larger setae, each lobe with one seta about 72μ long and two shorter elongate setae, several auxiliary setae and body pores. Anal ring small, about 43μ in diameter, its structure often indistinct, setae averaging about 58μ long, shorter and more slender than largest lobe setae; outer part of anal ring with 10–12 oval cells, twice as long as wide, most with spicules and touching end to end; cells of inner part usually larger and more irregular; shaded area not clearly distinguishable. Tritubular cerores of 3 sizes, all with short stout ducts, distributed

as follows: Large size, 12μ–13μ in diameter, confined to dorsum, 5 extending from head to abdominal segment VI along or near middorsal line; medium-sized cerores, 9μ–11μ in diameter, occurring ventrally, 1 on head, 3 or 4 along submarginal borders of abdominal segments V, VII, and VIII; small cerores, 5μ–7μ in diameter, present ventrally from segments IV to VIII, 0–3 on IV, 1–5 on V, 2–10 on VI, 5–13 on VII, and 3–8 on VIII. Multilocular disk pores occurring in some numbers on venter of posterior abdominal segments and in transverse rows across posterior borders of segments V–VII, elsewhere, except on head, usually widely isolated on both surfaces. Tubular ducts usually absent. Trilocular pores rather evenly distributed, not abundant. Body setae short, moderately sparse.

Holotype.—Puerto Barrios, Guatemala, 9–V–45, E. J. Hambleton. **Paratypes.**—Four taken with holotype, 13 from same location and date on different host and from Retalhulew, Guatemala, 17–V–45, E. J. Hambleton. USNM.

Host Plants.—*Cymbopogon citratus, C. nardus, Echinochloa colonum, Eleusine indica, Musa paradisiaca* var. *sapientum, Panicum maximum, Paspalum conjugatum, Setaria geniculata, Xanthosoma robustum,* undetermined Labiatae.

Distribution.—Guatemala, Honduras.

Guatemala: Puerto Barrios and Retalhulew, as recorded previously.

Honduras: La Lima, 1–IX–60, L. Roth; IX, X–67, Carlos Evers.

Discussion.—This species was originally described from two imported oil-producing grasses, *Cymbopogon citratus* and *C. nardus.* These plants are grown commercially in Guatemala. *R. mayanus* is here reported on roots of banana in Honduras.

The larger specimens of *mayanus* resemble *americanus;* the two species each possess three sizes of tritubular cerores, but the rostrum of *mayanus* is more elongate and its anal ring cells are larger and less sinuate than those of *americanus.* Type specimens of *mayanus* lack tubular ducts, yet occasionally an isolated duct is present in the Honduran specimens. On the average, *mayanus* has twice as many small tritubular cerores as *americanus.*

Rhizoecus menkei McKenzie

(Figs. 205–211)

Rhizoecus menkei McKenzie, 1962: 673.

Adult Female.—Oval elongate, small. Length, 1.19 mm; width, 0.65 mm. Antennae six-segmented, average length of segments: I, 35; II, 18; III, 27; IV, 17; V, 17; VI, 45; apical segment about twice as long as wide, with three moderately stout, elongate, weakly tapering, falcate sensory setae and one slender, acute, spinelike sensory seta; segment V with one narrow, shorter sensory seta. Interantennal space equal to combined length of segments I and II. Eyes rather prominent, slightly longer than wide, weakly pigmented. Rostrum elongate, about 67μ long, 44μ wide; rostral loop extending to or slightly beyond insertion of second pair of legs. Cephalic plate fairly prominent, measuring 33μ long, 47μ wide. Dorsal ostioles well developed but weakly sclerotized.

Legs with average length of segments of hind pair: Trochanter, 44; femur, 88; tibia, 84; tarsus, 53; claw, 24; claw digitules short, setose, not half as long as rather stout, elongate, curved claws.

With one thin-rimmed truncate circulus, its apex faveolate. Anal lobes slightly protruding, each lobe area with prominent sclerotized patch, one seta about 66μ long, two shorter setae, and usual pores and body setae. Anal ring small, approximately 50μ wide, its structure clearly defined, its setae about as long as longest lobe seta, anterior pair somewhat stouter than other two pairs, latter about as stout as lobe setae; outer part of anal ring with 12–14 elongate cells, wide at middle with tapered ends, each with spicule; cells of inner part of ring larger, more irregular in shape; clouded area containing some large globular cells anteriorly. Bitubular cerores with ducts about 8μ long, not strongly divaricated, occurring dorsally and ventrally, 7 on head, 22–25 on thorax, 48 on abdomen, most addominal segments with 5–7. Multilocular disk pores more abundant ventrally from posterior apex to posterior border of abdominal segment VII, elsewhere usually absent except few occurring dorsally along submarginal borders of segment VIII. Tubular

ducts very small, about one-half diameter of trilocular pore, present in small numbers over entire derm. Trilocular pores and short body setae uniformly distributed over body surface.

Holotype.—One mile N. of Tepic, Nayarit, Mexico, 27-VIII-59, A. S. Menke and L. A. Stange. **Paratype.**—One taken with holotype. UCD.

Host Plant.—Unknown, taken in soil.

Distribution.—Known only from type locality.

Discussion.—*R. menkei* is more closely related to *bituberculatus* than to any other species. However, the prominent eyes, shorter legs, more elongate cells of the outer part of the anal ring, somewhat longer and more numerous bitubular cerores, and absence of multilocular disk pores from the head and thorax distinguish *menkei* from *bituberculatus*. Contrary to McKenzie's belief, both of these species have tubular ducts.

Rhizoecus mexicanus (Hambleton), new combination

(Figs. 212–217)

Ripersiella mexicana Hambleton, 1946a: 67.

Adult Female.—Elongate oval. Average measurements of two specimens, length, 1.60 mm; width, 0.87 mm. Antennae six-segmented, comparatively small, moderately widely spaced, average length of segments: I, 28; II, 16; III, 30; IV, 15; V, 14; VI, 39; apical segment about twice as long as wide, with three long, moderately slender, falcate sensory setae and one spinelike sensory seta; segment V with one much narrower and shorter sensory seta. Interantennal space equal to combined length of segments I–III. Eyes small, moderately protuberant, lightly pigmented. Rostrum elongate, about 73μ long, 47μ wide; rostral loop reaching to or slightly beyond insertion of second pair of legs. Cephalic plate very small, insignificant, with two visible vacuoles. Dorsal ostioles not observed.

Legs of medium size, length of segments of hind pair: Trochanter, 33; femur, 79; tibia, 67; tarsus, 44; claw, 14; claw digitules elongate, dilated, reaching beyond rather short, stout claws.

With one large, truncate, faveolate circulus, about 43μ at its widest diameter, its orifice about 27μ wide, comparable in width to anal ring, strongly sclerotized. Anal lobes undeveloped, unsclerotized, each lobe area with one seta about 50μ long and two shorter setae. Anal ring 43μ wide, its structure clearly defined, anterior pair of ring setae about 56μ long, fairly stout, other 2 pairs shorter and about half as stout as anterior pair; outer part of ring consisting of 11 or 12 rather uniform sinuate cells, each with prominent spicule near its center; inner part of ring with 10–12 larger, more irregularly elongate cells lying adjacent to circular clouded area composed of semicircular or triangulate cells. Bitubular cerores present, their individual ducts stout, about 9μ long, weakly projecting above derm, occurring dorsally and ventrally in about following proportions: 8–9 on head, 20 on thorax, 40 on abdomen, most abundant dorsally. Multilocular disk pores present on both surfaces but more numerous ventrally on three caudal abdominal segments, occasionally an isolated one occurring elsewhere. Tubular ducts common, more than half as long as ceroris ducts and smaller in diameter than trilocular pore, widely scattered over entire derm. Trilocular pores sparse ventrally, especially in thoracic area, elsewhere more or less evenly distributed. Body setae variable in length, most short and sparsely distributed over derm.

Holotype.—Mexico, locality unknown, intercepted at quarantine in San Francisco, Calif., 3-VI-35. **Paratype.**—One taken with holotype and mounted on same slide. USNM.

Host Plant.—Undetermined succulent and cactus.

Distribution.—Texas, Mexico.

Texas: Locality unknown, taken at St. Petersburg, Fla., via Texas, 7-III-73, C. K. Hickman.

Mexico: Locality unknown.

Discussion.—This species was inadvertently omitted by Ferris (*1953*) and by McKenzie (*1960b, 1967*). *R. mexicanus* closely resembles *solani* but may be distinguished by its larger circulus, smaller bitubular cerores, and more slender falcate setae.

Rhizoecus nakaharai, new species

(Figs. 218–227)

Rhizoecus cacticans (Hambleton): McKenzie, 1967: 381 (misidentification in part).
Rhizoecus leucosomus (Cockerell): McKenzie, 1967: 398 (misidentification in part).

Adult Female.—Elongate ovate. Length, 1.25–3.22 mm; width, 0.56–1.73 mm. Antennae six-segmented, moderately stout, average length of segments: I, 44; II, 24; III, 36; IV, 22; V, 23; VI, 51; apical segment slightly less than twice as long as wide, with three rather narrow, elongate, falcate sensory setae and one shorter, narrow, spinelike sensory seta; segment V with one short, narrow, occasionally weakly clavate sensory seta. Interantennal space equal to combined length of antennal segments V and VI. Eyes weakly protruding, often difficult to observe, and may be absent. Rostrum stout, slightly longer than wide, about 77μ long, 68μ wide; rostral loop short, seldom reaching halfway to insertion of second pair of legs. Cephalic plate usually longer than wide, quadrate or triangulate, with two or three vacuoles and bordered with several body setae. Dorsal ostioles well developed.

Legs robust, average length of segments of hind pair: Trochanter, 45; femur, 108; tibia, 96; tarsus, 60; claw, 24; claw digitules elongate, their apices dilated, extending beyond basally stout, elongate, curved claws.

With one conical circulus, its base measuring between 20μ and 30μ. Anal lobes undeveloped, each lobe area with small sclerotized patch between three elongate setae, longest about 74μ long, and two much shorter setae. Anal ring well defined, its periphery often hexagonal-shaped rather than circular, about 69μ in diameter; its ring setae approximately 85μ long, much stouter and longer than lobe setae; outer part of anal ring with 24–48 rather small, oval, elongate, or triangulate cells, many almost touching; inner part of ring with 18 large irregular cells bordered inwardly by circle of large, ovate dark cells. Tritubular cerores small, 36–46 present, 7–10 dorsally along median line from head to abdominal segment VIII, and 21–36 dorsally and ventrally, most along submarginal borders. Multilocular disk pores absent. Tubular ducts small, few, usually confined to dorsum of abdomen. Trilocular pores rather evenly distributed on both surfaces but less abundant on thorax. Body setae short, sparse, longer and more numerous across posterior abdominal segments.

Holotype.— Discovery Bay (Jefferson County), Wash., 5–IX–66, Sueo Nakahara; USNM. **Paratypes.**—Five taken with holotype; USNM. Forty additional paratypes from following locations: *California:* Coches Prietos, Santa Cruz Island, Santa Barbara County, 10–V–68, D. R. Miller; El Centro, Imperial County, 25–II–63, G. O. Poinar and D. W. Ricker; one-half mi S. Gold Lake, Sierra County, 3–XI–66, T. R. Haig; N. Grizzley Island, Solano County, 20–X–69, R. O. Schuster; Los Banos, Merced County, 23–IV–68, T. R. Haig; Rohnersville, Humboldt County, 29–III–56, B. F. Kemp. *Idaho:* Three mi N. Ashton, Fremont County, 21–VIII–64, D. R. and J. F. Miller; Craters of the Moon National Monument, Butte County, 4–VII–67, D. S. Horning; 8–VIII–67, D. R. Miller and D. S. Horning; 20 mi N. Spencer, Clark County, 5–VIII–67, D. R. Miller and D. S. Horning. *Montana:* 1½ mi SSW. Winett, Petroleum County, via W. H. Burleson, 1971. *Oregon:* Mapleton, Larie County, 5–VIII–68, D. R. Miller and R. F. Denno. *Washington:* Blewett, Chelan County, 4–VIII–66, Sueo Nakahara. Thirty-six UCD, four USNM.

Host Plants.—*Agropyron* sp., *Carex* sp., *Cyperus rotundus, Distichlis spicata, Dudleya greenei, Eriogonum heracleoides, Juncus balticus, Lithospermum ruderale.*

Distribution.—California, Idaho, Montana, Oregon, Washington.

Discussion.—This species has been confused in the literature with *cacticans* and *leucosomus*. *R. nakaharai* resembles *leucosomus*, particularly in the size and shape of the rostrum and the nature of the cellular structure of the anal ring. However, the presence of an elongate sclerotized area on the anal lobes is characteristic of *nakaharai* and will separate it at once from *leucosomus* and *cacticans*.

It is a pleasure to name this species in honor of my friend, Sueo Nakahara, whose dedication to the collection and identification of the Coccoidea has helped increase our knowledge of these insects.

Rhizoecus nemoralis (Hambleton)

(Figs. 228–234)

Morrisonella nemoralis Hambleton, 1946a: 33.
Rhizoecus nemoralis: Ferris, 1953: 456.

Adult Female.—Broadly ovate. Length, 1.64–2.08 mm; width, 1.00–1.19 mm. Antennae six-segmented, moderately stout, widely spaced, average length of segments: I, 46; II, 24; III, 39; IV, 22; V, 21; VI, 50; apical segment less than twice as long as wide, tapered, with three moderately stout, bluntly tapered, falcate sensory setae and one spinelike sensory seta; segment V with one short, stout, lanceolate sensory seta. Interantennal space equal to combined length of segments II–VI. Eyes small but prominent, subconical, pigmented. Rostrum elongate, 98μ long, 51μ wide; rostral loop reaching almost to insertion of second pair of legs. Cephalic plate absent. Dorsal ostioles prominent, heavily sclerotized, surrounded by numerous pores and body setae.

Legs stout, average length of segments of hind pair: Trochanter, 67; femur, 135; tibia, 100; tarsus, 86; claw, 27; claw digitules short, acute, extending to about one-half the length of long, stout claws.

Circulus absent. Anal lobes weakly protruding, without sclerotization, each lobe area with three elongate setae, longest about 92μ long and five to eight short body setae and numerous pores. Anal ring about 49μ wide, its structure fairly distinct, its setae averaging about 72μ long, shorter and more slender than largest lobe seta; outer part of anal ring with 10–12 irregularly elongate cells, some with elongate spicules; cells of inner part somewhat larger, 8 lying adjacent to clouded area of large oval-shaped cells. Tritubular cerores of 2 sizes, larger or medium size occurring dorsally, 5 along dorsomedian line from head to abdominal segment VIII; 5 or 6 along submarginal borders; 28–37 small cerores present ventrally near body margin and scattered elsewhere. Multilocular disk pores numbering 5–11, confined to venter near vulva. Tubular ducts few, also occurring in area of vulva. Trilocular pores rather numerous and evenly distributed. Body setae conspicuous, variable in length, longest setae approximately 50μ long.

Holotype.—Along roadside, between Quetzaltenango and Totonicapan, Guatemala, 10,000 ft elevation, 20–V–45, E. J. Hambleton. **Paratypes.**—Two taken with holotype. USNM.

Host Plants.—*Alchemilla orbiculata, Citrus sinensis.*

Distribution.—At type locality and Antiqua, Guatemala, 25–V–45, E. J. Hambleton.

Discussion.—Ferris (*1953*) was not convinced that *nemoralis* and *cyperalis* were distinct. This was probably because of the limited amount of material available for study. Based on my studies it is clear that these species are closely related. Until more material of *cyperalis* is available, it seems advisable to consider the two as distinct. See discussion under *cyperalis*, page 22.

Rhizoecus neomexicanus McKenzie

(Figs. 235–240)

Rhizoecus neomexicanus McKenzie, 1962: 674.

Adult Female.—Oval elongate. Length of holotype, 0.83 mm; width, 0.37 mm. Antennae six-segmented, length of segments as follows: I, 29; II, 19; III, 17; IV, 16; V, 13; VI, 34; apical segment tapered, less than twice as long as wide, with three rather stout, falcate sensory setae, their tips weakly tapered, and one elongate, more acute sensory seta; segment V with one elongate, narrow sensory seta. Interantennal space equal to less than length of segment I. Eyes small, with little pigmentation. Rostrum approximately 63μ long, 44μ wide; rostral loop extending little beyond insertion of second pair of legs. Cephalic plate triangular, about 35μ wide. Dorsal ostioles moderately conspicuous, their rims weakly pigmented.

Legs relatively short, of medium size, segments of middle pair of legs as follows: Trochanter, 25; femur, 70; tibia, 47; tarsus, 42; claw, 18; claw digitules short, acute, about one-half as long as slender, acute claws.

Circulus absent. Anal lobes somewhat produced and slightly sclerotized, each lobe with three elongate setae of varying lengths, longest about 45μ, slightly longer and stouter than ring setae. Anal ring about 38μ wide, its setae averaging about 44μ long; outer part of anal ring not well defined, cells appearing to be longer

than wide; inner part of ring indistinct. Tritubular cerores short, stout, of two sizes, larger cerores present only on dorsum, one on head, five on thorax, one on abdominal segment V, and two on segment IX; smaller cerores occurring ventrally, two on abdominal segment V, four on VII, and two on IX. Multilocular disk pores present on both surfaces but more numerous ventrally from posterior border of abdominal segment VII to apex, few scattered elsewhere on abdomen and thorax, absent from head. Tubular ducts distributed lightly over entire derm. Trilocular pores most numerous dorsally, sparsely scattered ventrally. Body setae short, some longer setae on head and along posterior abdominal margins.

Holotype.—Alazan, Vera Cruz, Mexico, 15–VIII–59, A. S. Menke and L. A. Stange. **Paratype.**—One taken with holotype. UCD.

Host Plant.—Unknown, taken in jungle soil.

Distribution.—Known only from the type locality.

Discussion.—Three slides labeled *Rhizoecus neomexicanus* McKenzie represent the type material, which forms the basis for the previous redescription of this species. Unfortunately there are two species among the five individuals mounted on the three slides. One slide labeled "type" has the true *neomexicanus* and an immature female of *tropicalis*, new species. A second slide labeled "paratype" contains one female of *neomexicanus* in the process of molting and one apparently mature female of *tropicalis*. On the third slide, also labeled "paratype" is an adult female of *tropicalis* but no *neomexicanus*. The holotype of *neomexicanus* probably had not attained its full life size and is not in the best condition; therefore, its redescription is incomplete.

R. neomexicanus is smaller and has fewer tritubular cerores than *caladii*.

Rhizoecus neostangei Miller and McKenzie

(Figs. 241–245)

Rhizoecus neostangei Miller and McKenzie, 1971: 588.

Adult Female.—Oval elongate, stout. Length, 1.86 mm; width, 1.08 mm. Antennae six-segmented, moderately stout, widely spaced, length of segments: I, 44; II, 23; III, 26; IV, 21; V, 22; VI, 55; apical segment not twice as long as wide, with three elongate, medium thick, rather bluntly tapered, falcate sensory setae and one spinelike sensory seta; segment V with one elongate, narrow, weakly clavate, curved sensory seta. Interantennal space equal to combined length of segments IV–VI. Eyes small, rather prominent, lightly pigmented. Rostrum 86μ long, 62μ wide; rostral loop extending only slightly beyond apex of rostrum. Cephalic plate broader than long, 33μ long, 39μ wide, with body seta on each dorsolateral margin. Dorsal ostioles well developed, heavily sclerotized, with numerous trilocular pores along their rims.

Legs rather large, segments of hind pair measuring as follows: Trochanter, 60; femur, 124; tibia, 101; tarsus, 77; claw, 29; claw digitules short, setose, not reaching middle of rather long, stout, weakly curved claws.

Circulus absent. Anal lobes weakly protruding, each lobe area with small sclerotized patch, three elongate setae, longest about 66μ long, and usual pores and setae. Anal ring not clearly defined, about 53μ wide, its setae about same thickness as lobe setae but slightly shorter than longest, averaging 63μ long; outer part of ring probably with no more than 10–12 elongate, oval cells most with small spicules; cells of inner part of ring and clouded area not discerned. Tritubular cerores of 2 sizes, 19 large ones occurring dorsally, 7 along middorsal line from head to abdominal segment VI, 12 submarginally along thorax and abdomen; 10 medium-sized cerores present ventrally from abdominal segments V to VIII. Multilocular disk pores present on venter only, about 60 located from posterior margin of abdominal segment VII to anal ring and few between or near legs. Tubular ducts absent. Trilocular pores distributed dorsally and ventrally. Body setae rather short, slender.

Holotype.—Jalapa (Rio Cedeno), Vera Cruz, Mexico, 16–VIII–67, D. R. Miller and J. Villanueva B.; UCD.

Host Plant.—*Rhus* sp.,

Distribution.—Known only from the type locality.

Discussion.—This species is closely related to *R. stangei* but differs from it in lacking dorsal

multilocular disk pores and in possessing fewer medium-sized tritubular cerores on its venter.

Rhizoecus nitidalis Hambleton

(Figs. 246–250)

Rhizoecus nitidalis Hambleton, 1946a: 57.

Adult Female.—Broadly ovate, stout. Length, 1.70–3.06 mm; width, 0.94–1.99 mm. Antennae five-segmented, large, average length of segments: I, 55; II, 25; III, 45; IV, 31; V, 98; segment I rather stout, apical segment approximately three times as long as wide, with four stout, elongate, strongly tapered, falcate sensory setae, posterior seta smaller, shorter, and one narrow, spinelike sensory seta near apex. Interantennal space equal to slightly more than width of segment I at its base. Eyes absent. Rostrum elongate, averaging 106μ long, 70μ wide; rostral loop extending halfway or more to insertion of second pair of legs. Cephalic plate twice as wide as long, 82μ wide, 39μ long, with three to six vacuoles near and along its posterior border and several body setae along anterior margin. Dorsal ostioles conspicuous, their rims narrow but strongly sclerotized.

Legs well developed, large, with considerable variation in size, average lengths of segments of hind pair: Trochanter, 67; femur, 160; tibia, 119; tarsus, 80; claw, 40; claw digitules very short, finely setose, less than one-half the length of long, narrow, weakly curved claws.

Circulus absent. Anal lobes slightly protruding, each lobe with irregularly rounded sclerotized patch, three elongate, stout setae, longest about 81μ long, five or six short auxiliary setae, and small concentration of pores. Anal ring about 58μ in diameter, of simple, concise design, its setae averaging about 60μ long, shorter and weaker than largest lobe seta; outer part of anal ring with 10 or 12 elongate, pointed cells, each with spicule; cells of inner part of ring irregularly elongate and larger, 10 usually touching and lying adjacent to undifferentiated shaded area. Tritubular cerores of 2 sizes present, larger about 12μ wide, smaller about 5μ wide, both with short, stout ducts; large cerores occurring dorsally, 16 present on median line and along or near body margins from head to abdominal segment VIII; smaller cerores numbering between 45 and 51 ventrally in more or less transverse rows across abdominal segments IV–IX; segment VII with as many as 15 in some specimens. Multilocular disk pores of five to seven loculi distributed on both surfaces, but more numerous on posterior abdominal segments, gradually diminishing in numbers anteriorly and absent from frons. Tubular ducts about same diameter as trilocular pores, apparently confined to abdominal area. Trilocular pores almost circular, rather uniformly distributed. Minute circular pores half the size of trilocular pores scattered over most of derm. Body setae usually short, variable in size and length, some longer setae along body margins and on head.

Holotype.—Guarujá, State of São Paulo, Brazil, 22–VIII–35, B. L. Ribeiro and E. J. Hambleton. **Paratypes.**—Five mounted with holotype on same slide and 30 from other host at same location. USNM.

Host Plants.—*Axonopus* sp., *Cenchrus echinatus*, *Paspalum vaginatum*.

Distribution.—Known only from the type locality.

Discussion.—*R. nitidalis* resembles *falcifer* in general appearance. It differs in having sclerotized anal lobes with fewer elongate setae, fewer and different distribution of cerores, its multilocular disk pores with five to seven loculi, and in having shorter and more sparsely distributed body setae.

Rhizoecus ornatus (Hambleton), new combination

(Figs. 251–258)

Ripersiella ornata Hambleton, 1946a: 70.

Adult Female.—Oval elongate. Length, 1.44 mm; width, 0.75 mm. Antennae six-segmented, relatively small, length of segments: I, 29; II, 20; III, 24; IV, 16; V, 16; VI, 37; apical segment less than twice as long as wide, with three stout, bluntly tapered, falcate sensory setae and one elongate, spinelike, apical sensory seta; segment V with one short, stout, lanceolate sensory seta constricted near its base. Interantennal space less than width of segment I. Eyes

rather prominent, protruding, weakly pigmented. Rostrum about 60μ long, 38μ wide; rostral loop extending to or slightly beyond insertion of second pair of legs. Cephalic plate present, weakly pigmented, not well defined. Dorsal ostioles inconspicuous, their rims thin, weakly sclerotized.

Legs of medium size, length of segments of hind pair: Trochanter, 35; femur, 74; tibia, 65; tarsus, 41; claw, 25; claw digitules elongate, weakly dilated apically, reaching tip of long, narrow, curved claws.

With two elliptical circuli about 21μ wide, with thinly sclerotized rims, their orifices reticulose, with 15–18 polygonal-shaped cells. Anal lobes undeveloped, unsclerotized, each lobe area with three slender, elongate setae, longest about 38μ long and three or four body setae. Anal ring unique, 65μ wide, its setae comparatively short and stout, each about 55μ long, setae shorter than diameter of ring; outer part of anal ring with 10 large, isolated, oval, elongate cells, 2–3 times longer than wide, each with prominent spicule; inner part of ring with 6–8 more elongate cells lying adjacent to darkened area or concentric ring of large oval cells. Tritubular cerores of 2 distinct types, larger ceroris strongly depressed with short ducts, about 7μ in diameter, occurring dorsally in interrupted rows across segments VII and VIII, 9–11 on VII, and 19–22 on VIII; smaller cerores of more normal type with short ducts, about 4μ in diameter, usually encircled by trilocular pores, more common on head and thorax and along body margins on both surfaces. Multilocular disk pores absent. Tubular ducts not observed and considered absent. Trilocular pores distinctly triangulate, rather numerous, tending to form bands across abdominal segments. Body setae small, some longer setae across abdominal segments, along body margins, and on head.

Holotype.—Trinidad, British West Indies, 3–III–44, A. H. Strickland. **Paratypes.**—Two from same location, 6–VI–35, E. J. H. Berwick. USNM.

Host Plants.—*Coffea arabica, Theobroma cacao.*

Distribution.—Known only from type locality.

Discussion.—*R. ornatus* is one of several interesting hypogeic mealybugs from Trinidad. Because of their unusual morphological characters, they differ from other members of the genus. This species may be distinguished by its tritubular cerores with their short, stout ducts.

Borchsenius (*1949*) described a species under the name *"Rhizoecus ornatus"* from the Crimea. Since *ornatus* Borchsenius is a secondary homonym of *ornata,* the name of the Crimean species should be changed. The Trinidad and Crimean taxa are both valid species.

Rhizoecus ovatus, new species

(Figs. 259–263)

Adult Female.—Broadly ovate. Length, 1.58 mm; width, 1.05 mm. Antennae six-segmented, widely spaced, average length of segments: I, 48; II, 26; III, 47; IV, 21; V, 26; VI, 65; apical segment twice as long as wide, with three narrow, elongate, strongly tapered, falcate sensory setae and one spinelike sensory seta; segment V with one shorter, narrow sensory seta. Interantennal space equal to combined length of segments V and VI. Eyes absent. Rostrum rather large, conical, 95μ long, 73μ wide; rostral loop extending almost halfway between insertion of second and third pair of legs. Cephalic plate inconspicuous, weakly sclerotized, its shape undiscernible. Dorsal ostioles well developed, but with weakly sclerotized rims.

Legs long, average length of segments of hind pair: Trochanter, 55; femur, 134; tibia, 101; tarsus, 55; claw, 28; claw digitules slender, elongate, setose, reaching to or slightly beyond stout, strongly curved claws.

With one truncate circulus, its orifice about 14μ in diameter. Anal lobes undeveloped, unsclerotized, each lobe area with two stout, elongate setae, longest about 86μ long, and one shorter, more slender seta and five or six smaller auxiliary setae. Anal ring large, well defined, about 78μ wide, its setae about same size as lobe setae but appearing to be slightly longer; outer part of anal ring consisting of 35–40 rather small, irregularly quadrate or rounded cells, most being longer than wide, isolated, and in places forming a double row; inner part of ring with about 20 much larger

and irregularly oval, elongate cells, their ends touching and lying adjacent to ill-defined darkened area. Tritubular cerores small to medium, their ducts weakly tapered, at least 45–50 occurring dorsally, and uniformly distributed from head to abdomen. Multilocular disk pores absent. Tubular ducts rather prominent, short, stout, 6μ–7μ long, slightly smaller in diameter than tritubular ceroris, distributed dorsally and ventrally, anterior abdominal segments each with 7 to 11 tubular ducts. Trilocular pores more abundant dorsally. Body setae short, longer, and more abundant dorsally.

Holotype.—Mexico, location unknown, taken in quarantine at Bellflower, Calif., 2-IV-40, L. E. Meyers; UCD. **Paratypes.**—Three taken with holotype, one UCD, two USNM.

Host Plant.—*Mammillaria* sp.

Distribution.—Known only from Mexico.

Discussion.—With the exception of *falcifer*, this is the only known Mexican species that lacks eyes. The presence of prominent tubular ducts, their size, abundance, wide distribution, and slender, tapering, falcate sensory setae are distinguishing features of this species. One specimen has circuli on the venter of each of three abdominal segments, a normal-sized circulus on abdominal segment IV, and a smaller circulus on each of segments III and V.

Rhizoecus pauciporus, new species

(Figs. 264–268)

Adult Female.—Broadly ovate. Length, 1.87 mm; width, 1.05 mm. Antennae six-segmented, rather stout, tapering toward apex, length of segments: I, 50; II, 22; III, 40; IV, 24; V, 21; VI, 50; apical segment about twice as long as wide, with three moderately stout, elongate, falcate sensory setae and one smaller, elongate, spinelike sensory seta near its apex; segment V with one shorter, fairly stout, lanceolate sensory seta. Interantennal space equal to combined length of segments I, II, and III. Eyes prominent, longer than wide, strongly pigmented. Rostrum elongate, 103μ long, 64μ wide; rostral loop nearly reaching insertion of second pair of legs. Cephalic plate apparently absent. Dorsal ostioles prominent, heavily sclerotized, surrounded by numerous pores and body setae.

Legs apparently rather large, all broken except right hind leg, its dimensions as follows: Trochanter, 66; femur, 138; tibia, 90; tarsus, 88; claw, 30; claw digitules probably short, setose, not observed; claws stout.

Circulus absent. Anal lobes weakly protruding, each lightly sclerotized, and with three elongate setae, longest about 85μ long, (most of setae lost in mounting), and with concentration of pores. Anal ring about 46μ wide, its structure not clearly defined, its setae shorter and somewhat more slender than largest lobe seta; outer part of anal ring with no more than 12–14 oval, elongate cells, some with spicules; inner part with fewer similar cells, darkened area indistinct. Tritubular cerores present in 2 sizes, larger about 8μ–9μ in width, their individual ducts short, stout, 20 occurring dorsally, 6 along median line from head to abdominal segment VII, 7 submarginally along both sides from head to abdominal segment VIII; smaller cerores, normally 8 occurring ventrally, 4 on thorax, 1 pair each on segments VII and VIII in submarginal areas. Multilocular disk pores inconspicuous, only three, each with six loculi, near vulva. Tubular ducts present, strongly sclerotized, equal to or larger in diameter than trilocular pores, more numerous near vulva, few scattered elsewhere. Trilocular pores fairly large, variable in size, some almost circular, most abundant, and uniformly distributed dorsally. Circular pores about one-half the diameter of trilocular pore present dorsally in small numbers, more visible across and near posterior borders of segments V and VI. Body setae usually short, relatively sparse, some longer setae on head.

Holotype.—Ten mi NW. Comitan, Chiapas, Mexico, 22-VIII-67, J. Reddell, J. Fish, and T. Evans; USNM.

Host Plant.—Unknown, taken in surface debris.

Distribution.—Known only from type locality.

Discussion.—The shape of the antennae and eyes, the sparsity of multilocular disk pores, its well-defined tubular ducts, and presence of circular pores separate this species from its relatives.

Rhizoecus poensis (Hambleton), new combination

(Figs. 269–273)

Morrisonella poensis Hambleton, 1946a: 35.

Adult Female.—Elongate oval, moderately stout. Length, 1.54–1.96 mm; width, 0.77–1.12 mm. Antennae six-segmented, widely spaced, average length of segments: I, 45; II, 28; III, 30; IV, 27; V, 22; VI, 56; apical segment tapered, not quite twice as long as wide, with three moderately stout, weakly tapered, falcate sensory setae and one spinelike sensory seta; segment V with one narrow, extremely elongate sensory seta. Interantennal space about equal to combined length of segments IV–VI. Eyes prominent, protuberant, weakly pigmented. Rostrum stout, 77μ long, 65μ wide; rostral loop extending approximately halfway to insertion of second pair of legs. Cephalic plate poorly defined, wider than long, about 44μ wide, containing numerous indistinct vacuoles. Dorsal ostioles inconspicuous, thinly rimmed, weakly sclerotized, anterior pair almost indistinguishable, posterior pair with numerous body setae surrounding them.

Legs robust, average length of segments of hind pair: Trochanter, 61; femur, 140; tibia, 103; tarsus, 85; claw, 33; claw digitules short, setose, reaching middle of moderately stout, curved claws.

Circulus absent. Anal lobes simple, weakly developed, unsclerotized, each lobe with three elongate setae, longest about 85μ long, and six to eight short auxiliary setae. Anal ring about 50μ in diameter, its setae long and slender, slightly narrower than stoutest lobe seta, averaging about 73μ long; outer part of anal ring with 10–12 narrow, elongate cells, each with spicule; inner part of ring with cells similar but somewhat larger; clouded area with oval-shaped cells. Tritubular cerores of 2 distinct sizes, their ducts short, stout, larger size about 8μ–9μ in diameter, occurring dorsally, 7–10 along each body margin, 5–10 along middorsal line; smaller cerores about 6μ–7μ in diameter, occurring ventrally, 5–9 submarginally along each side and usually 1 pair near midventral area on each of segments V–VIII. Multilocular disk pores relatively abundant, especially in posterior abdominal area, occurring on both surfaces over entire derm. Tubular ducts absent. Trilocular pores uniformly distributed. Medioventral pores in 2 clusters ventrally on abdominal segments VI and VII, anterior cluster with 5–12 pores, posterior cluster with 5–14 pores. Body setae moderately dense, variable in size, 10μ–55μ long, longest on head and along body margins.

Holotype.—Bogota, Colombia, at 10,000 ft, 27–X–44, E. J. Hambleton. **Paratypes.**—Nine taken with holotype, two mounted on same slide with holotype. USNM.

Host Plant.—*Poa annua.*

Distribution.—Known only from type locality.

Discussion.—*R. poensis* is one of three species having two clusters of medioventral pores. Both *globoculus* and *theobromae* possess these pores and are closely related to *poensis.* However, *poensis* may be distinguished by its unsclerotized anal lobes, presence of multilocular disk pores on the head, and the more slender falcate setae.

Rhizoecus polyporus, new species

(Figs. 274–282)

Adult Female.—Oval elongate. Length, 1.73 mm; width, 1.02 mm. Antennae six-segmented, elongate, rather stout, length of segments: I, 44; II, 30; III, 50; IV, 24; V, 29; VI, 62; apical segment at least twice as long as wide, with three elongate, fairly slender, falcate sensory setae and one shorter, spinelike sensory seta near its apex; segment V with one much shorter, lanceolate sensory seta. Interantennal space about equal to length of segment VI. Eyes small, rather depressed, pigmented. Rostrum stout, 106μ long, 77μ wide; rostral loop extending between insertion of second and third pair of legs. Cephalic plate arrowhead-shaped, longer than wide, about 60μ long, 37μ wide, with vacuoles near its center and two body setae on its posterior margin. Dorsal ostioles well developed, strongly sclerotized.

Legs rather large, segments of hind pair measuring as follows: Trochanter, 61; femur, 156; tibia, 136; tarsus, 77; claw, 23; claw digitules setose, elongate, extending beyond stout, apically curved claws.

With two circuli (probably only one occurring normally), one large, truncate, about 50μ in diameter, 34μ across its finely faveolate orifice, located on segment IV, and smaller one of similar shape on segment III. Anal lobes undeveloped, without sclerotization, each lobe area with three elongate setae, two of them about 80μ long, third much shorter, and several body setae and two cerores. Anal ring conspicuous, measuring 89μ in diameter, its structure clearly defined, its setae stouter and longer than lobe setae, anterior pair about 95μ long; outer part of anal ring consisting of 48–50 rather small, oval, diversiform, isolated cells, in places forming double row; inner part of ring with circle of larger, irregularly shaped cells, about 20 lying adjacent to shaded undifferentiated area. Tritubular cerores of medium size, their individual ducts about 10μ long, rather strongly divaricating and weakly tapered, projecting well above derm and occurring dorsally and ventrally in large numbers, approximately 130 on head and thorax, 108 on abdomen; dorsally cerores are arranged in rather uniform rows across abdominal segments. Multilocular disk pores absent. Tubular ducts short, stout, strongly sclerotized, 5μ–6μ in diameter, slightly smaller than cerores, present over entire derm, some abdominal segments with as many as 20. Minute tubular ducts, referred to as "mushroom bodies," scattered widely over both surfaces. Trilocular pores fairly numerous, more abundant dorsally. Body setae variable in length, short, evenly distributed.

Holotype.—State of Sonora, Mexico, 29–III–67, intercepted at quarantine at Nogales, Ariz.; USNM.

Host Plant.—Unknown, taken in cacti debris.

Distribution.—Known only from the type locality.

Discussion.—This species and *relativus* are alike in having large, unusually stout tubular ducts and an abnormally large number of tritubular cerores. Both the size of the tubular ducts and large number of cerores are uncommon for *Rhizoecus*. *R. polyporus* differs from *relativus* in having longer legs and antennae, larger circulus, slender, nontapered sensory setae, and more numerous cerores.

Rhizoecus pritchardi McKenzie

(Figs. 283–289)

Rhizoecus pritchardi McKenzie, 1960b: 749; McKenzie, 1967: 400: Hambleton, 1973: 69.
Rhizoecus cyperalis (Hambleton): McKenzie, 1967: 383 (misidentification).
Rhizoecus eluminatus McKenzie, 1960b: 747; McKenzie, 1967: 387. NEW SYNONYMY.

Adult Female.—Elongate oval, moderately stout. Length, 1.62–2.10 mm; width, 0.95–1.33 mm. Antennae six-segmented, rather stout and widely spaced, average length of segments: I, 40; II, 21; III, 33; IV, 18; V, 18; VI, 43; apical segment narrowest, not twice as long as wide, with three moderately stout, falcate sensory setae and one spinelike sensory seta near apex; segment V with one much shorter, lanceolate sensory seta. Interantennal space equal to twice width of segment I. Eyes small, often weakly pigmented, difficult to observe. Rostrum elongate, 88μ long, 52μ wide; rostral loop not reaching insertion of second pair of legs. Cephalic plate absent. Dorsal ostioles well developed, their rims strongly sclerotized.

Legs normal for size of insect, moderately stout, elongate, average length of segments of hind pair: Trochanter, 49; femur, 109; tibia, 82; tarsus, 71; claw, 25; claw digitules short, acute, reaching about to middle of stout, curved claws.

Circulus absent. Anal lobes slightly developed or weakly protruding, unsclerotized, each lobe with one long and two shorter elongate setae, longest about 84μ long, and several body setae. Anal ring comparatively small, about 50μ wide, its setae shorter and narrower than longest lobe seta; outer part of anal ring with 12 elongate, oval cells, each with spicule; inner part of ring with cells of similar shape but larger; darkened area indistinct (anal ring of this species often assumes vertical position upon mounting and thus makes it difficult to ascertain the nature of the cellular structure). Tritubular cerores of 2 sizes, 25–28 of larger size present dorsally, 3 on head, 8–10 on thorax, 13–14 on abdomen; slightly smaller cerores, 4–6 occurring submarginally on abdomen. Multilocular disk pores, varying in size and shape, 11–21 present ventrally, usually near vulva on segments VIII and IX, occasionally

1 or 2 on VII. Tubular ducts absent. Trilocular pores abundant, well distributed, some areas of head and thorax occasionally with few pores. Circular pores occurring dorsally, very small, about one-half size of trilocular pore, from few to as many as 22 scattered across posterior borders of abdominal segments IV, V, and VI. Body setae variable in size, short and long setae about evenly distributed.

Holotype.—Colma, Calif., 17–I–57, E. L. Labadie and D. J. Bingham. **Paratypes.**—Several taken with holotype, UCD; paratypes also CAS, CDA, USNM. Holotype of *eluminatus*, Bayside, Calif., 24–IX–54, W. D. Thomas; paratypes taken with holotype. UCD, one paratype USNM.

Host Plants.—*Achillea ageratifolia, Adiantum* sp., *Arctostaphylos* sp., *Chrysanthemum* sp., *Geum coccineum, Lantana* sp., *Polygala crotalariodes, Saintpaulia ionantha, Sinningia speciosa.*

Distribution.—California, Florida, Illinois, Maryland, Massachusetts, New York, Pennsylvania, Canada.

California: Bayside, 24–IX–54, W. D. Thomas. Bellflower, 12–I–67, T. and H. Ryner. Berkeley, 25–IX–59, A. E. Pritchard. Colma, 24–II–55, W. E. Davis. Escondido, 21–II–56, A. A. Church. Napa, 30–XI–64, D. R. Hall. San Bruno, 29–IV–58, A. E. Pritchard. San Francisco, 29–IV–60, R. Michelsen. Santa Barbara, 18–II–60, M. Suskin. Visalia, 11–III–64, Phil Hemphill.

Florida: Apopka, 1–IV, 11–V–71, R. M. Remington. Gainesville, 23–V–68, E. Mercer. Largo, 22–IV–66, J. R. McFarlin.

Illinois: Elizabeth, 5–IV–64, F. F. Smith.

Maryland: Baltimore, 22–IV–65; Beltsville, 15–XII–65, 2–III–70, F. F. Smith. Cheverly, 4–XI–71, W. W. Cantelo.

Massachusetts: Waltham, 26–III–70, A. G. Gentile.

New York: Ithaca, 8–XII–61, D. S. Welsh. Scotia, 25–III–65, G. V. Johnson.

Pennsylvania: York, 22–VII–65, F. F. Smith.

Canada: Niagara Falls, Ontario, 22–XI–48, R. Sheppard.

Discussion.—McKenzie (*1960b*), in describing *eluminatus*, indicated the close relationship between it and *pritchardi*, pointing out that *eluminatus* differed principally in the absence of eyes. Close examination of the types indicates the presence of small, inconspicuous eyes in both species. Examination of a series of *pritchardi* specimens reveals that the eyes may be present or absent. In all other respects *eluminatus* and *pritchardi* are similar and therefore are here treated as synonyms. The name "*pritchardi*" has been selected as senior synonym because of its usage in economic literature.

R. pritchardi is readily separated from its closest allies by the absence of tubular ducts and presence of circular pores. It has more multilocular disk pores than either *cyperalis* or *nemoralis*, two of its nearest relatives.

Rhizoecus relativus, new species

(Figs. 290–293)

Adult Female.—Elongate oval. Length, 1.95 mm; width, 1.01 mm. Antennae six-segmented, moderately stout, length of segments: I, 36; II, 25; III, 40; IV, 25; V, 24; VI, 53; apical segment robust, not twice as long as wide, with three elongate, moderately stout, tapering, falcate sensory setae and one shorter, spinelike sensory seta; segment V with one much smaller, short, lanceolate sensory seta. Interantennal space equal to about combined length of segments I and II. Eyes absent. Rostrum stout, approximately 72μ long, 65μ wide; rostral loop reaching midway between first and second pairs of legs. Cephalic plate longer than wide, irregular in outline, narrow anteriorly, about 53μ long, 40μ wide, with four to five body setae on its borders. Dorsal ostioles inconspicuous, hind pair more prominent, all with weakly sclerotized rims.

Legs comparatively short, stout, (hind pair and one of second pair broken), length of segments of midleg: Trochanter, 41; femur, 94; tibia, 69; tarsus, 48; claw, 19; claw digitules elongate, weakly dilated, extending beyond rather stout, acute, curved claws.

With one medium-sized truncate circulus, 34μ at its base, 13μ across its orifice. Anal lobes undeveloped, unsclerotized, each lobe area with three elongate setae, longest about 77μ long, several shorter setae, body pores, and several cerores. Anal ring about 68μ in diameter, its cellular structure well defined, its ring setae

longer and stouter than lobe setae, longest about 75μ long; outer part of anal ring with 36–38 cells varying considerably in size and shape, some rounded, elongate, or triangulate, rather indiscriminately arranged; inner part of ring with 14–16 irregularly elongate, larger cells lying next to darkened area consisting of about 10 hemispherically shaped cells. Tritubular cerores small to medium, projecting well above derm, their ducts divaricating, present on both surfaces but more abundant dorsally, total of about 85 on head and thorax, 60 on abdomen. Multilocular disk pores absent. Tubular ducts short, stout, strongly sclerotized, diameter varying from that of triangular pore to ceroris, scattered widely over both surfaces. Mushroom bodies widely distributed over entire derm. Trilocular pores fairly uniformly distributed, more numerous on posterior abdominal segments but sparsely arranged in area along anterior and posterior margins of segments. Body setae short, varying somewhat in length, evenly distributed.

Holotype.—Three mi NE. Nogales Station, Cruz Co., Ariz., 1-VIII-66, D. R. Miller; UCD.

Host Plant.—Undetermined.

Distribution.—Known only from type locality.

Discussion.—The presence of large tubular ducts separates this species from *leucosomus*. As its name suggests, *relativus* is closely related to *polyporus*, but it differs from the latter in having shorter legs and antennae, a smaller circulus, differently shaped falcate setae, and fewer cerores. In *relativus* the eyes are lacking and the microscopic mushroom bodies are poorly defined.

Rhizoecus simplex (Hambleton)

(Figs. 294–298)

Ripersiella simplex Hambleton, 1946a: 73.
Rhizoecus cacticans (Hambleton): McKenzie, 1967: 381 (misidentification in part).
Rhizoecus simplex: Hambleton, 1973: 69.

Adult Female.—Oval elongate. Length, 0.87–1.39 mm; width, 0.38–0.66 mm. Antennae six-segmented, short, moderately stout, average length of segments: I, 25; II, 14; III, 20; IV, 12; V, 13; VI, 31; apical segment less than twice as long as wide, with three fairly stout, weakly tapered, falcate sensory setae and one spinelike sensory seta near apex; segment V with one shorter, clavate sensory seta. Interantennal space about equal to length of segment I. Eyes weakly protruding, lightly pigmented. Rostrum medium size, about 50μ long, 35μ wide; rostral loop extending almost to insertion of second pair of legs. Cephalic plate irregular in outline, 37μ long, 35μ wide, containing two vacuoles and bordered by five or six body setae. Dorsal ostioles inconspicuous, lightly sclerotized.

Legs small, rather stout, segments of hind pair measuring as follows: Trochanter, 28; femur, 58; tibia, 56; tarsus, 36; claw, 15; claw digitules elongate, dilated at tips, extending to end of long, rather acute claws.

With one more or less truncate circulus, 13μ wide at its base, its orifice roughly faveolate. Anal lobes undeveloped, unsclerotized, each lobe area with three slender, elongate setae, longest about 37μ long. Anal ring about 46μ wide, its setae averaging about 50μ long, stouter than lobe setae; outer part of anal ring consisting of 17–23 oval cells with spicules; inner part of ring with about 14 larger diversiform cells lying adjacent to circular area of darkened hemispherical cells. Tritubular cerores small, variable in number, 48–68 present, most numerous dorsally, their ducts elongate, about 7μ–8μ long, and projecting well above derm. Multilocular disk pores absent. Tubular ducts small, elongate, present on both surfaces but more numerous ventrally. Trilocular pores evenly distributed, not numerous. Body setae short, slender, rather sparse.

Lectotype.—São Paulo City, São Paulo, Brazil, 10-IV-35, B. L. Ribeiro and E. J. Hambleton. **Paralectotypes.**—Four taken with lectotype and mounted on same slide, seven additional paralectotypes taken on different hosts in same locality mounted on four slides. USNM.

Host Plants.—*Brassaia* sp., *Calendula* sp., *Carissa grandiflora, Coccoloba uvifera, Cordyline* sp., *Cryptanthus* sp., *Dieffenbachia* sp., *Dizygotheca elegantissima, Erigeron bonariensis, Eriobotrya japonica, Euphorbia milii, Gardenia jasminoides, Hamatocactus setispinus, Hedera helix, Hoya carnosa* cv. *exotica, Ixora coccinea, Neoregelia* sp., *Nephrolepsis exaltata, Oxalis martiana, Panicum* sp., *Peperomia* sp.,

Pilea microphylla, Plantago sp., *Saintpaulia* sp., *Strelitzia reginae, Zygocactus* sp., *Z. truncatus.*

Distribution.—California, Florida, New York, Washington, Brazil.

California: Berkeley, Alameda Co., 4–XI–58, H. L. McKenzie and A. E. Pritchard.

Florida: Apopka, 21–I–71, F. L. Ware. Bradenton, 1–I–71, J. R. McFarlin. Eau Gallie, 8–II–71, H. C. Levan. Englewood, 16–I–73, C. J. Bickner. Fairvilla, 2–II–71, F. L. Ware. Fort Lauderdale, 14–II–72, J. R. Halstead. Gainesville, 19–VI–70, John Perry. Gotha, 1–VIII–61, R. J. Griffith. Homestead, 23–IV–71, J. H. Knowles. Key West, 1–I–73, E. J. Hambleton. Leesburg, 13–V–71, A. L. Bentley. Lockhart, 29–I–71, F. L. Ware. Orlando, 10–II–71, W. W. Smith and E. R. Fatic; 21–V–71, F. L. Ware. Osprey, 5–II–71, J. R. McFarlin. Oxford, 22–IV–71, A. L. Bentley. Palma Sola, 7–XII–67, J. R. McFarlin. Pompano Beach, 10–VI–63, M. L. Bank. Sebastian Inlet, 12–II–71, H. C. Levan. Snead Island, 2–IV–71; Tallavast, 30–III–71, J. R. McFarlin. Upper Key Largo, 3–II–68, R. E. Woodruff. W. Melbourne, 9, 12–II–71, H. C. Levan. Winter Garden, 11–I–65, 26–II–65, R. J. Griffith; 19–II–68, F. L. Ware. Zellwood, 28–IX–73, P. Gibson and W. Pierce.

New York: Syracuse, XI–72, 27–II–73, C. A. Cooke.

Washington: Bellingham, 4–IX–65, C. A. Leckie; 10–VI–68, B. J. Landis.

Brazil: The type locality.

Discussion.—Because a holotype was not indicated in the original description of *simplex,* I hereby designate the first specimen on the left in the bottom row in a field of five individuals on slide No. 1 as the lectotype.

The study of a long series of specimens from Florida has proved invaluable in confirming the validity of *simplex.* Its present distribution, including the new record for New York, represents a considerable extension in the known range of the species.

R. simplex is about one-half the size of *cacticans,* and both species differ in the size and shape of their antennae and rostra. The cells of the outer part of the anal ring in *simplex* are mostly oval elongate and number 17–23, whereas in *cacticans* there are 32–40 larger, subtriangulate to quadrate cells in the outer part of the ring.

Rhizoecus solani (Hambleton)

(Figs. 299–303)

Ripersiella solani Hambleton, 1946a: 75.
Rhizoecus solani: Ferris, 1953: 458.

Adult Female.—Elongate oval. Length, 1.35–1.53 mm; width, 0.66–0.71 mm. Antennae six-segmented, rather widely spaced, average length of segments: I, 32; II, 18; III, 31; IV, 17; V, 17; VI, 45; apical segment not quite twice as long as wide, with three moderately stout, bluntly tapered, falcate sensory setae and one elongate, spinelike sensory seta; segment V with shorter, narrow sensory seta. Interantennal space equal to combined length of segments V and VI. Eyes fairly prominent, weakly pigmented. Rostrum elongate, measuring 73μ long, 41μ wide; rostral loop reaching almost to insertion of second pair of legs. Cephalic plate weakly indicated, appearing to be longer than wide. Dorsal ostioles inconspicuous.

Legs rather stout, average length of segments of hind pair: Trochanter, 37; femur, 96; tibia, 81; tarsus, 59; claw, 20; claw digitules elongate, weakly dilated apically, extending to or slightly beyond rather stout claws.

With one medium-sized conical circulus, 25μ across its base, its orifice about 10μ in diameter, finely faveolate. Anal lobes weakly protruding, unsclerotized, each lobe with three elongate setae, two of them longer and stouter than the third, longest about 74μ long. Anal ring appearing slightly wider than long, measuring 49μ in diameter, its setae about as long and stout as lobe setae; outer part of ring with 12–15 elongate, sinuate cells practically touching end to end, each with spicule near its center; cells of inner part of ring 10–12, larger and more irregular in shape, lying adjacent to clouded area of subcircular cells. Bitubular cerores present, about 13μ long, rather stout, 45–48 present mostly dorsally and submarginally, 21–22 on head and thorax, 24–26 on abdomen, walls of ducts parallel, two ducts lying side by side, or with their bases diverging, pro-

jected part slightly above derm. Multilocular disk pores 45–50, occurring across venter of posterior three abdominal segments and occasionally 1 over same area dorsally. Tubular ducts small, widely distributed over derm. Trilocular pores moderately abundant and uniformly distributed. Body setae variable in length, most short, not prominent.

Holotype.—Guatemala City, Guatemala, 12–V–45, E. J. Hambleton. **Paratypes.**—Three taken with holotype. USNM.

Host Plant.—*Solanum nigrum.*

Distribution.—Guatemala, Mexico.

Guatemala: The type locality.

Mexico: 15 mi S. Llera, Tamaulipas, 24–II–72, D. R. Miller and F. D. Parker.

Discussion.—As indicated under the discussion of *mexicanus,* that species and *solani* are closely related. See page 37 and the key to species for their major differences.

Rhizoecus sonomae McKenzie

(Figs. 304–309)

Rhizoecus sonomae McKenzie, 1960b: 751; McKenzie, 1961: 47; McKenzie, 1964: 269; McKenzie, 1967: 402.

Rhizoecus browni McKenzie, 1961: 43; McKenzie, 1967: 376. NEW SYNONYMY.

Adult Female.—Elongate oval. Length, 0.91–1.84 mm; width, 0.46–0.91 mm. Antennae six-segmented, average length of segments: I, 33; II, 20; III, 36; IV, 21; V, 21; VI, 51; apical segment about twice as long as wide, with three long, narrow, falcate sensory setae and one distal, spinelike sensory seta; segment V with one shorter, narrow, weakly clavate sensory seta. Interantennal space equal to about combined length of segments III and IV. Eyes weakly protuberant, lightly pigmented. Rostrum moderately stout, 71μ long, 53μ wide; rostral loop extending to about insertion of second pair of legs. Cephalic plate usually slightly wider than long, well sclerotized, bordered anteriorly by three small body setae. Dorsal ostioles well developed, inconspicuous.

Legs of average size, length of segments of hind pair: Trochanter, 45; femur, 94; tibia, 86; tarsus, 63; claw, 22; claw digitules long, slender, dilated at tips, reaching beyond moderately stout, curved claws.

With one elongate, conical circulus, about as wide at base as long. Anal lobes undeveloped, each lobe area with small sclerotized patch, three elongate setae, longest about 75μ long, small concentration of pores, and several body setae. Anal ring about 51μ wide, its structure distinct, its anterior pair of setae stoutest, remaining pairs about as stout but shorter than longest lobe seta; outer part of anal ring with 17–20 small, elongate, oval cells, most with spicules; inner part of ring with 14 much larger, more irregular cells lying adjacent to darkened area of semicircular cells. Tritubular cerores of medium size, about 7μ long, walls of individual ducts almost parallel, projecting half their length above derm, about 30 dorsally along median line and submargin, on venter, about 15 occurring on submargin. Multilocular disk pores more abundant ventrally in area of vulva, as many as 28 on segment VIII, 26 across base of segment VII, 18 on segment IX, several on VI and areas opposite base of rostrum, elsewhere scattered; on dorsum, 3 present on VI, 3 on VII, 9 on VIII, 6 on IX. Tubular ducts small, evenly distributed on both surfaces, few on head. Trilocular pores fairly uniformly distributed, more sparse ventrally, especially in thoracic area. Body setae varying somewhat in length but most short and rather inconspicuous.

Holotype.—Two mi W. of Petrified Forest, Sonoma County, Calif., 23–II–59, W. R. Bauer and J. S. Buckett; UCD. **Paratype.**—One from same locality, 25–X–59, J. S. Buckett; CDA. Holotype of *browni,* 5 mi NW. Spanish Flat, Napa County, 1–III–61, S. W. Brown; UCD.

Host Plant.—Unknown, taken in leaf mold and trash from soil under *Juniperus* sp. and *Quercus wislizenii.*

Distribution.—California: Type locality. Graton, 20–II–60, C. L. Judson. Lucerne, 1–VI–61, R. O. Schuster. Wooden Valley, 29–IV–62, S. F. Bailey.

Discussion.—In attempting to key the species *sonomae* and *browni* on the basis of their original descriptions, certain characters appeared to differentiate the two forms. However, when types and other available material were studied, it became apparent that they could not be separated. In all specimens the sclerotization

of the anal lobes is very weak, the claw digitules are weakly dilated, and the anal ring structure, antennae, rostra, and other characters show no marked differences. Because of these similarities, *browni* is here considered a junior synonym of *sonomae*.

Rhizoecus spinipes (Hambleton)

(Figs. 310–315)

Morrisonella spinipes Hambleton, 1946a: 36.
Rhizoecus spinipes: Hambleton, 1973: 70.

Adult Female.—Broadly elliptical. Length, 1.32–1.64 mm; width, 0.91–1.19 mm. Antennae six-segmented, short, stout, closely placed near apex of head, segments in following lengths: I, 23; II, 18; III, 15; IV, 12; V, 11; VI, 34; apical segment stout, less than twice as long as wide, with three stout, strongly clavate, apically acute, falcate sensory setae and one spinelike sensory seta near apex; segment V with one narrow, elongate, curved sensory seta. Interantennal space about equal to width of segment I. Eyes small, rather prominent, weakly pigmented. Rostrum almost twice as long as wide, 57μ long, 31μ wide; rostral loop extending slightly more than halfway to insertion of second pair of legs. Cephalic plate spade-shaped, rather large, about 44μ long, with as many as 10 small body setae associated with it. Dorsal ostioles poorly developed, anterior pair apparently absent, posterior pair inconspicuous, weakly pigmented.

Legs small, robust, rather spinose, length of segments of hind pair: Trochanter, 30; femur, 58; tibia, 47; tarsus, 35; claw, 21; claw digitules not reaching half the length of long, slender claws.

Circulus absent. Anal lobes undeveloped, each lobe area with elongate sclerotized patch, with four slender, elongate setae, longest about 48μ long. Anal ring about 45μ in diameter, its setae shorter than its diameter, stout, apically acute, about 35μ long; outer part of anal ring with 12 rather large, elongate cells isolated from one another and with tiny spicules; inner part of ring with 8–10 similar cells lying adjacent to undifferentiated shaded area. Tritubular cerores large, their individual ducts stout, slightly tapered, about 11μ long, present on both surfaces, 3 on head, 8 on thorax, 12–14 on abdomen. Multilocular disk pores with six to seven loculi, present dorsally and ventrally, few but uniformly scattered, absent from head. Tubular ducts absent. Trilocular pores sparse, widely distributed. Body setae short, sparse, somewhat longer on head and on dorsum of posterior abdominal segments.

Holotype.—Howard County, Ark., 8–VI–36, W. F. Turner; USNM.

Host Plants.— *Andropogon rhizomatus, Panicum* sp., undetermined Gramineae, in soil under peach tree.

Distribution.—Arkansas, Florida, Georgia, Mexico.

Arkansas: Type locality.

Florida: Gainesville, 10–X–67, K. R. Langdon.

Georgia: Chattooga County, 4–XII–73, R. J. Beshear.

Mexico: Jalapa (Rio Cedeno), Vera Cruz, 16–VII–67, D. R. Miller and J. Villanueva B.

Discussion.—This unique species is distinguished by its short, stout, acute anal-ring setae, presence of four elongate setae on each anal lobe, shape of its falcate sensory setae, and multilocular disk pores with six or seven loculi.

R. spinipes was omitted by Ferris (*1953*) and by McKenzie (*1960b, 1967*).

Rhizoecus stangei McKenzie

(Figs. 316–320)

Rhizoecus stangei McKenzie, 1962: 676.

Adult Female.—Oval elongate. Length of type, 1.29 mm; width, 0.66 mm. Antennae six-segmented, stout, length of segments: I, 58; II, 33; III, 36; IV, 27; V, 27; VI, 64; apical segment less than twice as long as wide, with three moderately stout, falcate sensory setae tapering toward their extremities and one spinelike sensory seta near apex; segment V with one elongate, narrow, slightly clavate sensory seta. Interantennal space about equal to combined length of segments V and VI. Eyes prominent, rather globose, weakly pigmented. Rostrum comparatively stout, length 83μ, width 64μ;

rostral loop reaching insertion of second pair of legs. Cephalic plate approximately 33μ long and 46μ wide, with two body setae on anterior border. Dorsal ostioles well developed, heavily sclerotized.

Legs rather large, length of segments of hind pair: Trochanter, 59; femur, 123; tibia, 101; tarsus, 79; claw, 34; claw digitules very short, setose, hardly reaching half the length of long, stout, curved claws.

Circulus absent. Anal lobes slightly protruding, each lobe with small sclerotized patch, three elongate setae, longest about 51μ long, remaining two shorter, smaller, and with six to eight short body setae. Anal ring about 53μ wide, its setae of variable lengths and averaging about 60μ long, all longer and about as stout as stoutest lobe seta; outer part of anal ring with 10 rather large, elongate, oval cells, some with spicules and most isolated from each other; inner part of ring with about same number of cells of similar size; clouded area not clearly defined. Tritubular cerores fairly numerous, 2 sizes present, larger about 11μ wide, their ducts 8μ–9μ long, stout, about 18 occurring dorsally, 5 along median line from head to abdominal segment VI and 12 or 13 submarginally from thorax to abdominal segment VIII; smaller or medium ceroris 5μ–7μ wide and of similar shape, 44 or more occurring ventrally in rows across segments, of these, 23–28 are on segments VII and VIII. Multilocular disk pores abundant, over 100 observed on venter of abdominal segments III–IX, more numerous in area of vulva and across posterior borders of segments V–VIII, few occurring dorsally or near lateral margins, absent from head and thorax. Tubular ducts absent. Trilocular pores rather evenly distributed over both surfaces. Body setae most small, inconspicuous.

Holotype.—One mi N. Tepic, Nayarit, Mexico, 21–VIII–59, L. A. Stange and A. S. Menke. **Paratype.**—One taken with holotype. UCD.

Host Plant.—Unknown, collected from soil.

Distribution.—Type locality.

Discussion.—*R. stangei* seems to bear some relation to *americanus* and *mayanus*. The major difference between them is that *stangei* has only two sizes of tritubular cerores and possesses many more larger cerores on its ventral surface. It is also similar to *neostangei*.

Rhizoecus subcyperalis, new species

(Figs. 321–323)

Adult Female.—Broadly ovate elongate, stout. Length, 1.60–1.81 mm; width, 0.81–1.00 mm. Antennae six-segmented, short, rather stout, widely spaced, average length of segments: I, 41; II, 19; III, 35; IV, 18; V, 18; VI, 41; apical segment not twice as long as wide, tapering, with three comparatively narrow, elongate, falcate sensory setae and one elongate, spinelike sensory seta; segment V with one shorter, smaller sensory seta. Interantennal space equal to combined length of segments I–III. Eyes small, often inconspicuous, weakly pigmented. Rostrum elongate, 82μ long, 55μ wide; rostral loop reaching halfway to insertion of second pair of legs. Cephalic plate absent. Dorsal ostioles conspicuous, their rims strongly sclerotized.

Legs of average size, length of segments of hind pair: Trochanter, 46; femur, 105; tibia, 75; tarsus, 68; claw, 24; claw digitules short, acute, about reaching middle of elongate, curved claws.

Circulus absent. Anal lobes with some protrusion, unsclerotized, each lobe with three or four elongate setae, longest approximately 78μ long, and body pores concentrated around them. Anal ring about 51μ wide, usually resting at angle or vertically in mounted specimens, its setae each about 57μ long, as stout as but shorter than longest lobe seta; outer part of anal ring with 10–12 elongate, oval, or sinuate cells with spicules; inner part of ring with larger cells of similar shape but more irregular in outline. Tritubular cerores large, of one size, 18 occurring dorsally, 3 on head, 7 on thorax, 8 on abdomen. Multilocular disk pores 4–10, confined to venter in area of vulva. Tubular ducts small, few, located on venter of abdominal segments VIII and IX. Trilocular pores evenly distributed over both surfaces. Circular pores minute, sparse, occurring across dorsum of midabdominal segments. Body setae rather short, inconspicuous.

Holotype.—Portal, SW. Research Station, Cochise County, Ariz., 3–VIII–66, D. R. Miller; UCD. **Paratypes.**—Five taken with holotype, on four slides; six additional on six slides as follows: *Arizona:* Bisbee, Cochise County, 2–

VIII–66, D. R. Miller; Madera Canyon Station, Santa Cruz County, 31–VII–66, D. R. Miller. *Idaho:* Craters of the Moon National Monument, Butte County, 4–VII–66, D. S. Horning; 8 mi NE. Minkcreek, Franklin County, 3–VIII–67, D. R. Miller and D. S. Horning. Nine UCD, two USNM.

Host Plants.—*Lithospermum ruderale, Urtica lyallii,* under rocks, in soil.

Distribution.—Arizona, Idaho.

Discussion.—Twelve specimens in the UCD collection mislabeled *cyperalis, eluminatus,* and *pritchardi* form an integral group of individuals with like characters and are here considered new and described under the name *subcyperalis.* The true *cyperalis* from Central America does not appear to be present in California, Arizona, or Idaho; *eluminatus* has been synonymized with *pritchardi.* The latter species has 30–35 cerores of 2 sizes that occur both dorsally and ventrally, whereas *subcyperalis* has only 18 cerores of 1 size and they are restricted to the dorsum.

Rhizoecus theobromae (Hambleton), new combination

(Figs. 324–328)

Morrisonella theobromae Hambleton, 1946a: 39.

Adult Female.—Elongate oval, slightly constricted behind thorax. Length, 1.39–1.70 mm; width, 0.66–0.75 mm. Antennae six-segmented, comparatively short, widely spaced near apex of head, segments measuring as follows: I, 33; II, 18; III, 19; IV, 20; V, 17; VI, 42; apical segment less than twice as long as wide, sharply tapered, with three stout, apically obtuse, falcate sensory setae and one elongate, spinelike sensory seta; segment V with one elongate, stout, clavate sensory seta. Interantennal space equal to combined length of segments V and VI. Eyes rather prominent, hemispherical, pigmented. Rostrum of medium size, length about 67μ long, 48μ wide; rostral loop extending slightly beyond insertion of second pair of legs. Cephalic plate irregularly shaped, approximately 28μ long by 48μ wide, with several vacuoles and usually with body seta at each laterocephalic margin. Dorsal ostioles moderately conspicuous, their rims weakly pigmented, surrounded by numerous pores and body setae.

Legs of average size, length of segments of hind pair: Trochanter, 41; femur, 96; tibia, 74; tarsus, 55; claw, 25; claw digitules short, setose, hardly reaching half the length of long, rather stout, weakly curved claws.

Circulus absent. Anal lobes weakly developed, each lobe with light, irregular sclerotization, three slender, elongate setae, longest about 60μ, (others broken off in type), and several small body setae. Anal ring about 40μ in diameter, its setae about same thickness but shorter than longest lobe seta, measuring about 52μ long; outer part of ring containing 12 narrow, elongate cells with spicules and often touching end to end; cells of inner part of ring with about same number, somewhat larger but not well defined and lying next to darkened area with large, oval cell structure. Tritubular cerores present in two sizes, larger about 8μ wide occurring dorsally, five along median line from head to abdominal segment VI, eight submarginally; cerores about 5μ wide, present ventrally, one pair each on abdominal segments V and VII near midventral area. Multilocular disk pores most numerous on venter of posterior abdominal segments, 35–40 present, elsewhere, except on head, few pores widely scattered on both surfaces. Tubular ducts scarce, occurring on venter, opposite anal ring on anterior anal-lobe area. Trilocular pores uniformly distributed, most numerous dorsally. Medioventral pores in two clusters across midventral surface of abdominal segments VI and VII, 12–31 pores in each cluster. Body setae mostly short, some longer setae on head, prothorax, and posterior abdominal segments.

Holotype.—Pichilingue, Ecuador, 1–X–44, E. J. Hambleton. **Paratypes.**—Three (one mounted with holotype on same slide) and three preadult females. USNM.

Host Plant.—*Theobroma cacao.*

Distribution.—Known only from type locality.

Discussion.—This species, like the West Indian *globoculus,* has the peculiar medioventral pores and is found on the same host. Its stouter falcate setae, less globose eyes, and more abundant multilocular disk pores distinguish it from *globoculus.* Tubular ducts are present in *theo-*

bromae, though the original description of the species stated that they were absent.

Rhizoecus totonicapanus (Hambleton)

(Figs. 329–333)

Ripersiella totonicapana Hambleton, 1946a: 76.
Rhizoecus totonicapanus: Ferris, 1953: 460.

Adult Female.—Oval elongate. Length, 1.35–1.43 mm; width, 0.67–0.71 mm. Antennae six-segmented, moderately widely spaced, segments measuring as follows: I, 25; II, 17; III, 19; IV, 14; V, 13; VI, 39; apical segment less than twice as long as wide, with three elongate, moderately stout, weakly clavate, falcate sensory setae and one elongate, spinelike sensory seta located near apex; segment V with one short, clavate sensory seta. Interantennal space about equal to combined length of segments I–III. Eyes rather small with little pigmentation. Rostrum of average size, 62μ long, 41μ wide; rostral loop extending more than halfway to insertion of second pair of legs. Cephalic plate subquadrate, about 30μ long, 40μ wide, with two vacuoles and several body setae on its borders. Dorsal ostioles almost unrecognizable, without pigmentation.

Legs short, length of segments of hind pair: Trochanter, 33; femur, 68; tibia, 55; tarsus, 45; claw, 18; claw digitules long, slender, and appearing setose, extending to tip of relatively stout claws.

With one conical circulus, about 16μ wide across its base. Anal lobes not protruding, each lobe area with small, irregular sclerotized patch, three slender setae, longest about 60μ long, several body setae and pores. Anal ring about 50μ wide, its setae slender, anterior pair stoutest and about 62μ long; outer part of anal ring with 12–14 elongate, oval cells with spicules; inner part of ring with 10–12 larger, more irregular cells lying next to shaded area of rounded cell structure. Derm with bitubular cerores small, elongate, with ducts about 9μ long, weakly tapered, divaricating, present dorsally and ventrally, 19–22 on head and thorax, 23–27 on abdomen. Multilocular disk pores 31–43, present largely on venter of posterior abdominal segments, few occurring on dorsum. Tubular ducts about 5μ long, distributed on both surfaces in small numbers over entire derm. Trilocular pores fairly abundant, more numerous on dorsum. Body setae varying in length, some longer setae nearly 40μ long on head and abdomen.

Holotype.—Along roadside between Quetzaltenango and Totonicapan, Guatemala, 20–V–45, E. J. Hambleton. **Paratype.**—One taken with holotype. USNM.

Host Plant.—*Alchemilla orbiculata.*

Distribution.—Known only from type locality.

Discussion.—In addition to the differences pointed out between this species and *gracilis* (p. 29), the latter species is larger and the cells in the outer part of its anal ring are much narrower than those in *totonicapanus.*

Rhizoecus tropicalis, new species

(Figs. 334–339)

Rhizoecus neomexicanus McKenzie, 1962: 674 (misidentification in part).

Adult Female.—Oval elongate. Length, 1.29 mm; width, 0.64 mm. Antennae six-segmented, moderately short, stout, strongly geniculate, length of segments as follows: I, 21; II, 17; III, 19; IV, 15; V, 14; VI, 33; apical segment less than twice as long as wide, with three slender, bluntly tapered, weakly clavate, falcate sensory setae and one narrow, more acute sensory seta; segment V with one shorter, clavate sensory seta. Interantennal space about equal to combined length of segments V and VI. Eyes absent. Rostrum of medium size, 51μ long, 45μ wide; rostral loop almost reaching insertion of second pair of legs. Cephalic plate longer than wide, with four or five body setae along its periphery. Dorsal ostioles weakly sclerotized, inconspicuous.

Legs short, stout, length of segments of hind pair: Trochanter, 33; femur, 58; tibia, 55; tarsus, 35; claw, 15; claw digitules elongate, their tips dilated, extending beyond rather stout, weakly curved claws.

With one small, roundly truncate circulus, about 13μ wide at its base, its apex widely faveolate. Anal lobes undeveloped, each lobe area with small, irregularly elongate, sclero-

tized patch between one long and two shorter setae (mostly broken in types). Anal ring about 45μ in diameter, its setae approximately 55μ long, much stouter than lobe setae; outer part of anal ring with 19–21 elongate to ovate, loosely arranged, spiculate cells; inner part of ring with 10–12 larger, more elongate, and somewhat stouter cells, dark area poorly defined. Tritubular cerores small, their ducts about 6μ–7μ long, present dorsally and ventrally, 17–18 on head and thorax, 21–24 on abdomen, as many as 5 on abdominal segment VIII. Multilocular disk pores absent. Tubular ducts smaller in diameter than trilocular pores, widely distributed but most common ventrally, five or six present on most abdominal segments. Trilocular pores rather sparsely distributed, very few in some areas of abdominal segments. Body setae short, rather sparse.

Holotype.—San Rafael, Departamento San Marcos, Guatemala, 28–XII–63, J. G. Rodriguez. **Paratypes.**—Two taken in Guatemala in 1964 by Jesus Escobar, USNM; two, Alazán, State of Vera Cruz, Mexico, 15–VIII–59, A. S. Menke and L. A. Stage, UCD.

Host Plant.—*Coffea arabica.*

Distribution.—Guatemala, Mexico.

Guatemala: Type locality.

Mexico: Alazán, Vera Cruz, 15–VIII–59, A. S. Menke and L. A. Stange. This collecting record includes three specimens mistaken for *neomexicanus.* (See discussion under *R. neomexicanus,* p. 40.)

Discussion.—The structure of the anal ring, shape of the rostrum, and faveolate circulus are distinguishing characters of this species.

SUMMARY

In this bulletin 52 species of *Rhizoecus* Künckel d'Herculais are recognized, of which 12 are described as new; 33 of the 36 previously described New World species are retained as valid, and 3 names are synonymized; 7 species originally described under *Morrisonella* Hambleton and *Ripersiella* Tinsley are assigned to *Rhizoecus.* A key is presented to adult females of New World species. All taxa are described or redescribed and pertinent structures are illustrated. Host plant and distribution records are listed for each species.

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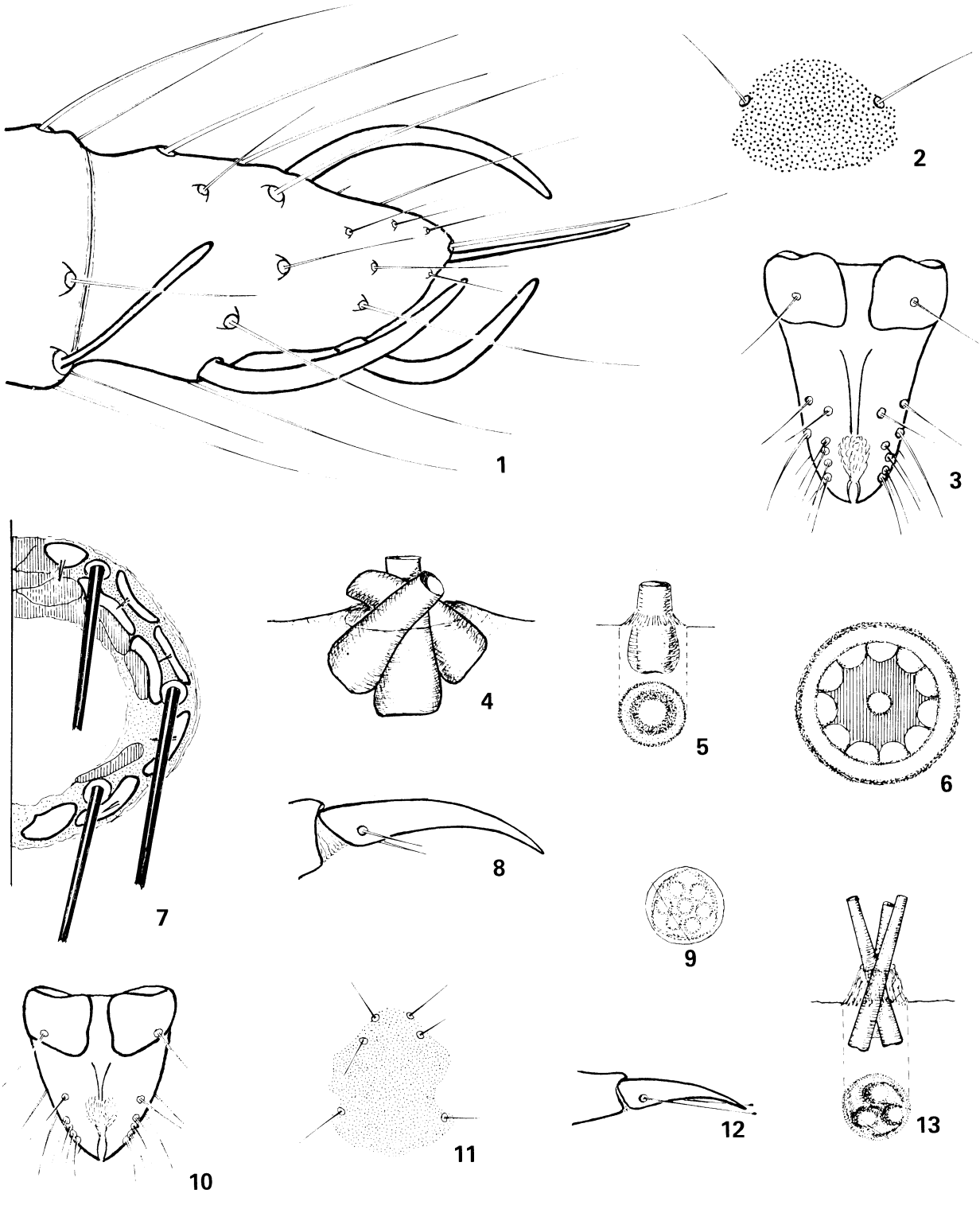
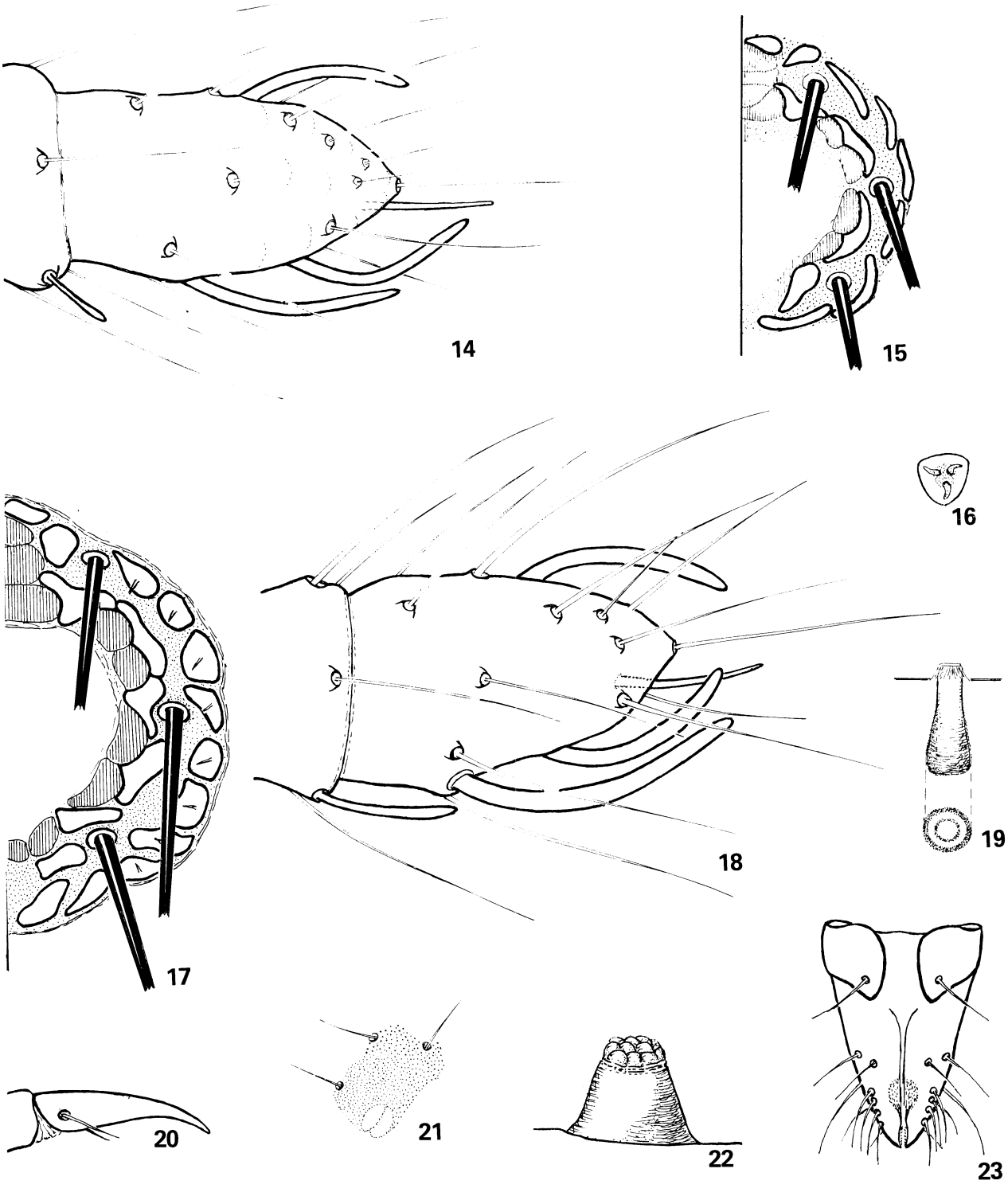
INDEX TO HOST PLANTS

INDEX TO MEALYBUGS

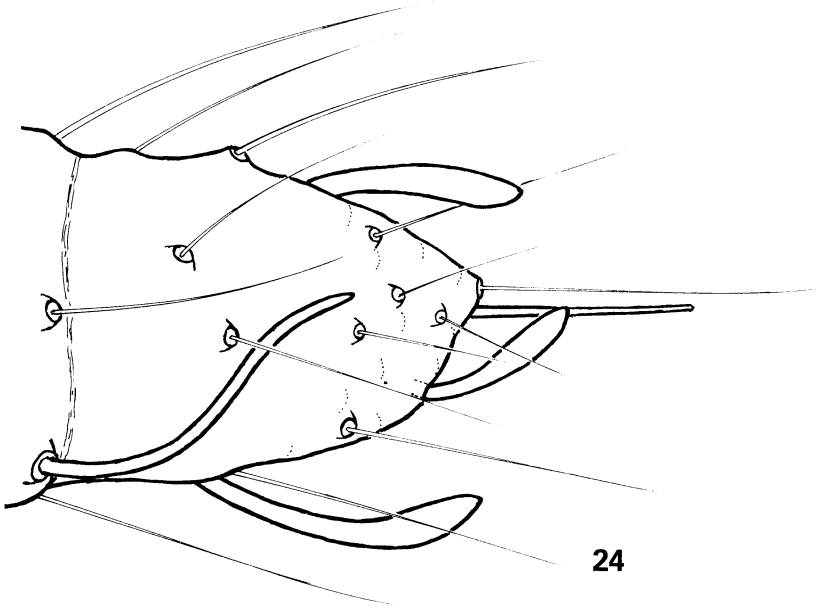
(Valid names are in roman type, synonyms in italic)

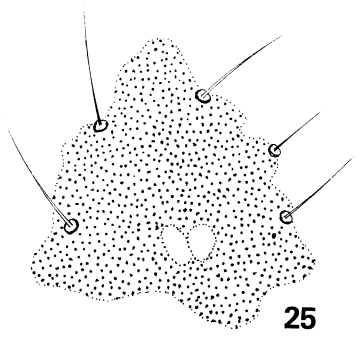


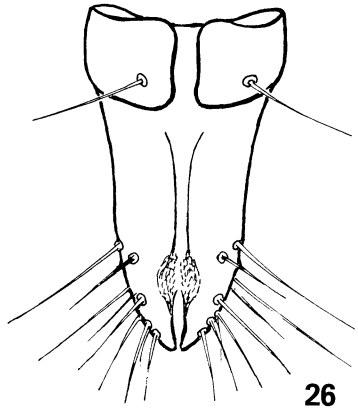
FIGURES 1–13.—*Rhizoecus americanus:* 1, Terminal segments of antenna; 2, cephalic plate; 3, rostrum; 4, tritubular ceroris, lateral; 5, tubular duct, lateral and ventral; 6, multilocular disk pore; 7, anal ring, right half; 8, hind claw; 9, trilocular pore. *R. apizacos,* new species: 10, Rostrum; 11, cephalic plate; 12, hind claw; 13, tritubular ceroris, lateral and ventral.

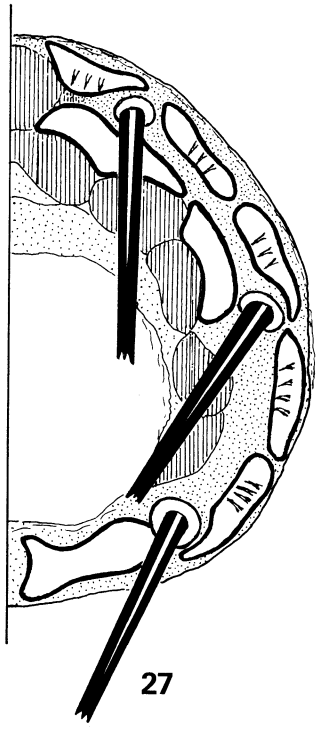


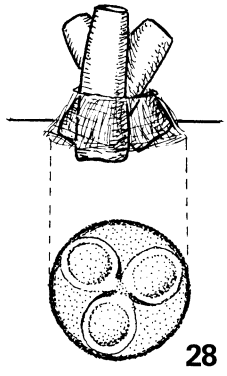
FIGURES 14–23.—*Rhizoecus apizacos*, new species: 14, Terminal segments of antenna; 15, anal ring, right half. *R. arabicus*, new species: 16, Trilocular pore; 17, anal ring, right half; 18, terminal segments of antenna; 19, tubular duct, lateral and ventral; 20, hind claw; 21, cephalic plate; 22, circulus, lateral; 23, rostrum.



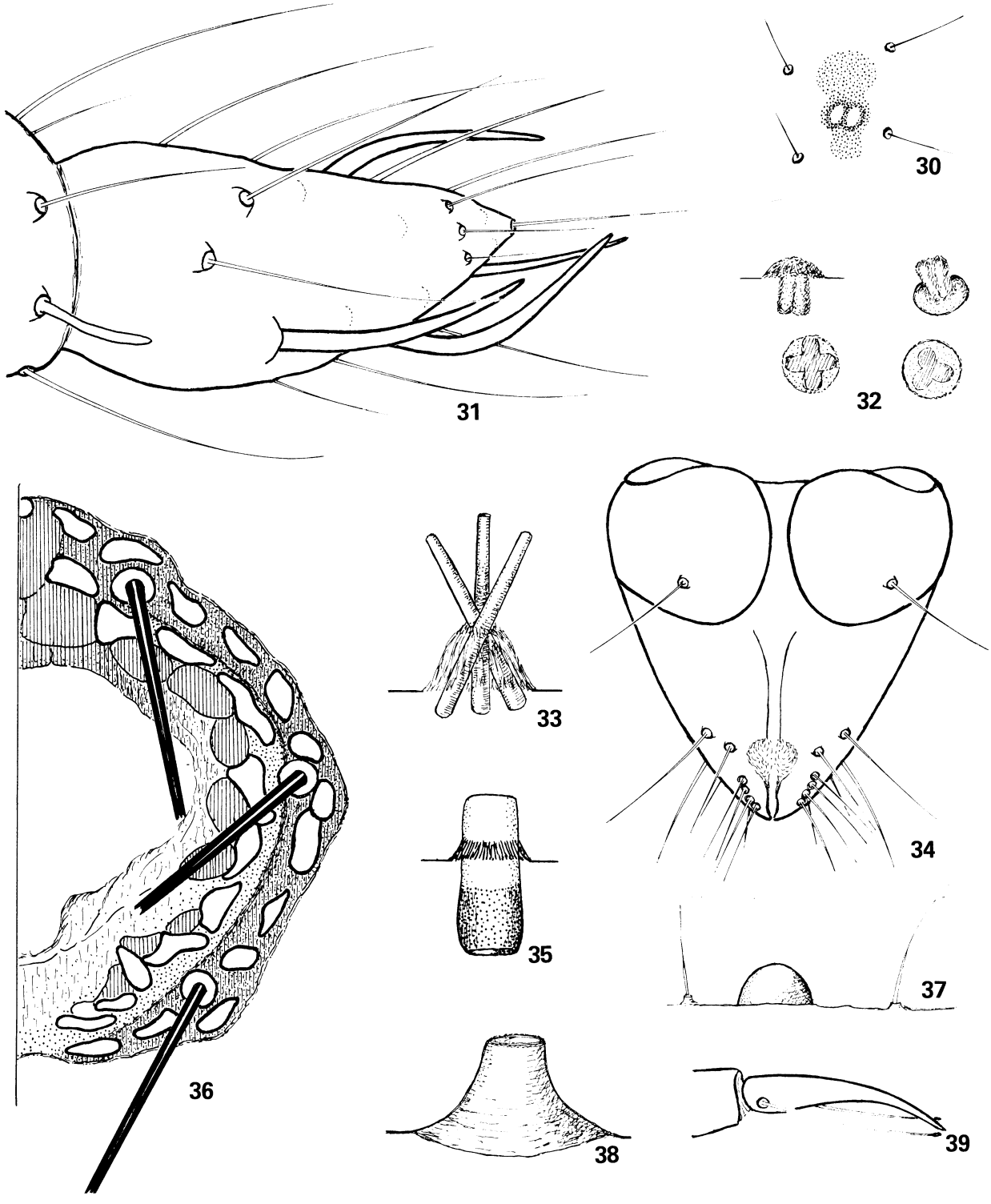




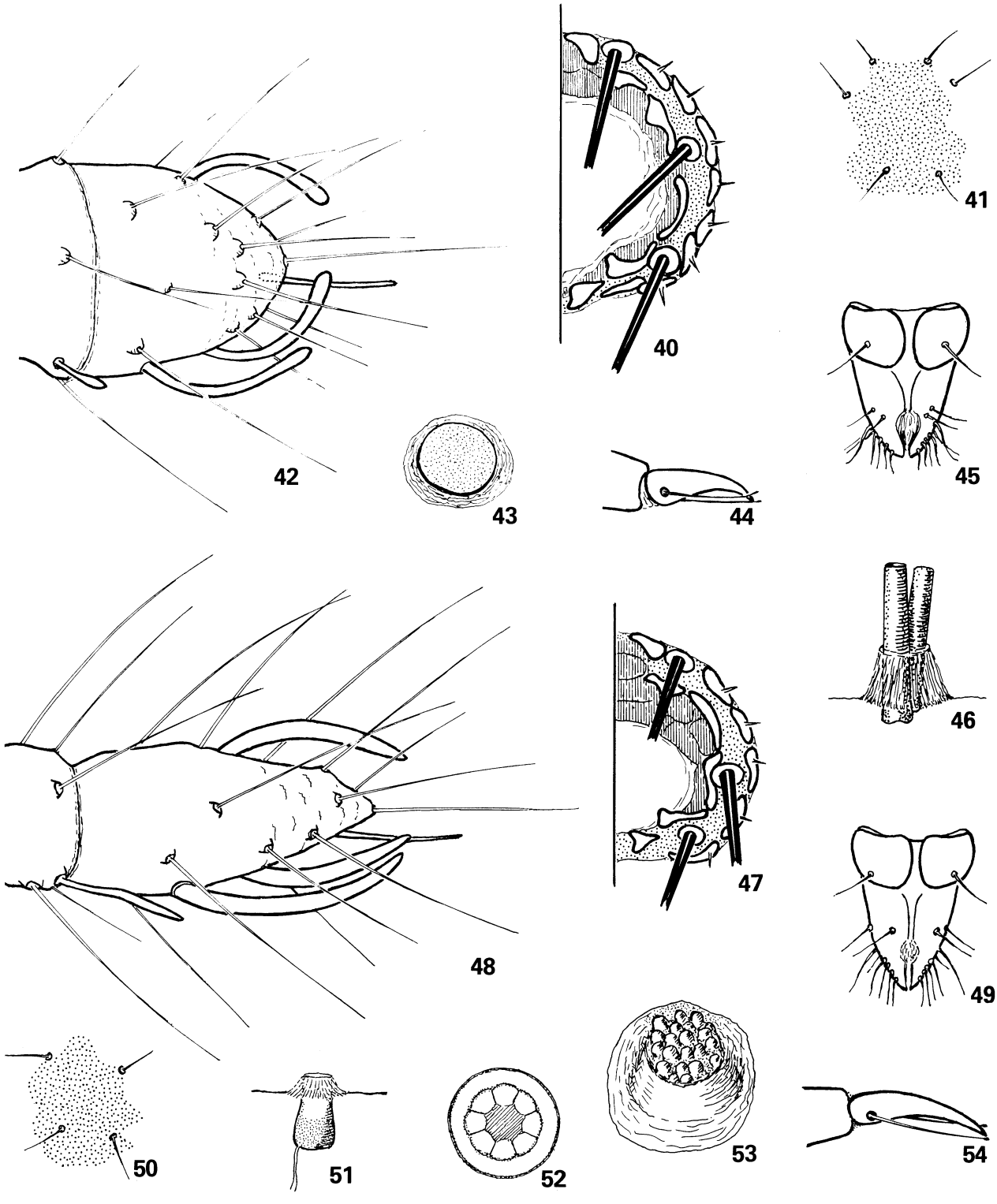




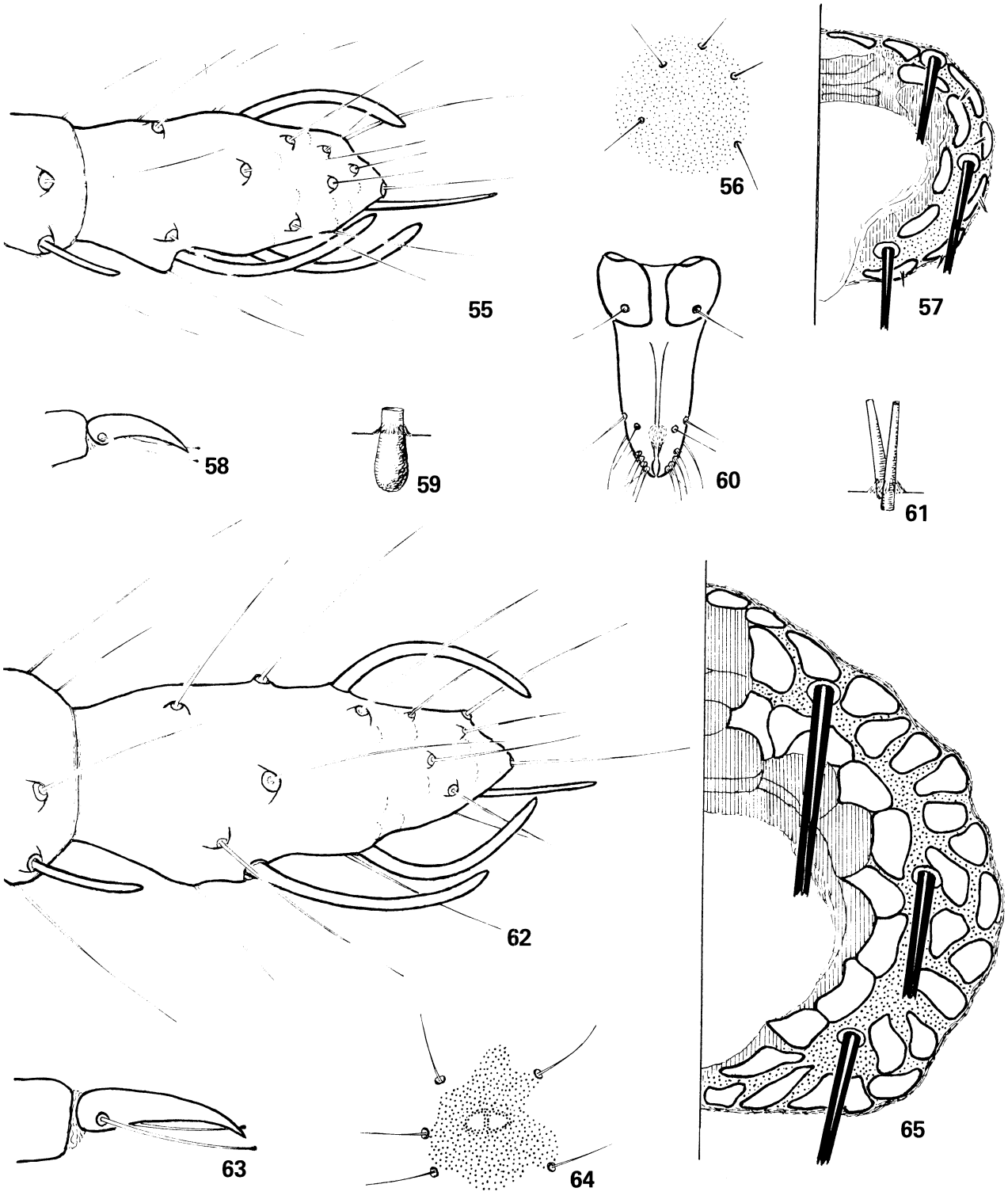
FIGURES 24–29.—*Rhizoecus associatus:* 24, Terminal segments of antenna; 25, cephalic plate; 26, rostrum; 27, anal ring, right half; 28, tritubular ceroris, lateral and ventral; 29, hind claw.



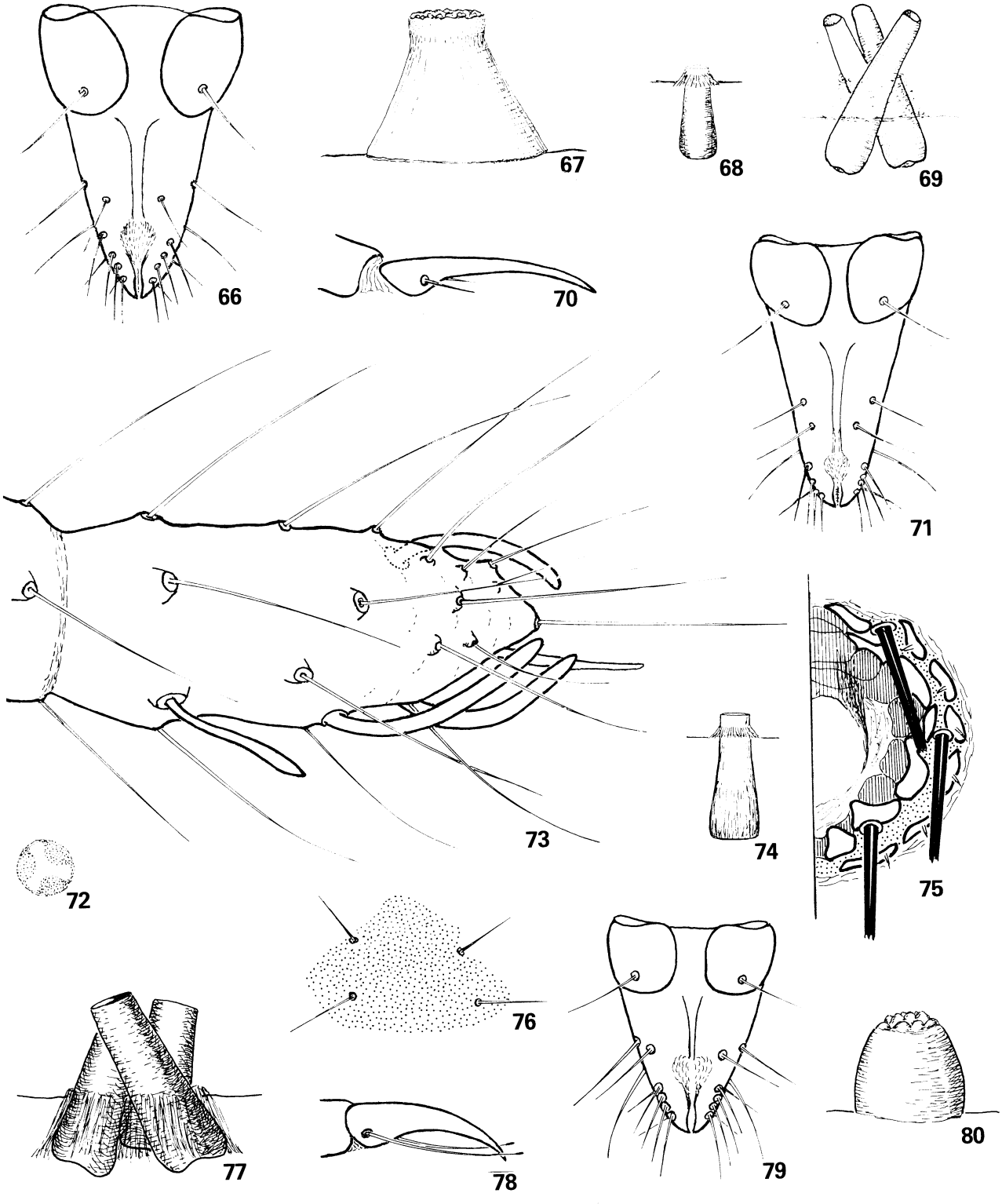
FIGURES 30–39.—*Rhizoecus atlanticus:* 30, Cephalic plate; 31, terminal segments of antenna; 32, mushroom bodies, various aspects; 33, tritubular ceroris, lateral; 34, rostrum; 35, tubular duct, lateral; 36, anal ring, right half; 37, eye, lateral; 38, circulus, lateral; 39, hind claw.



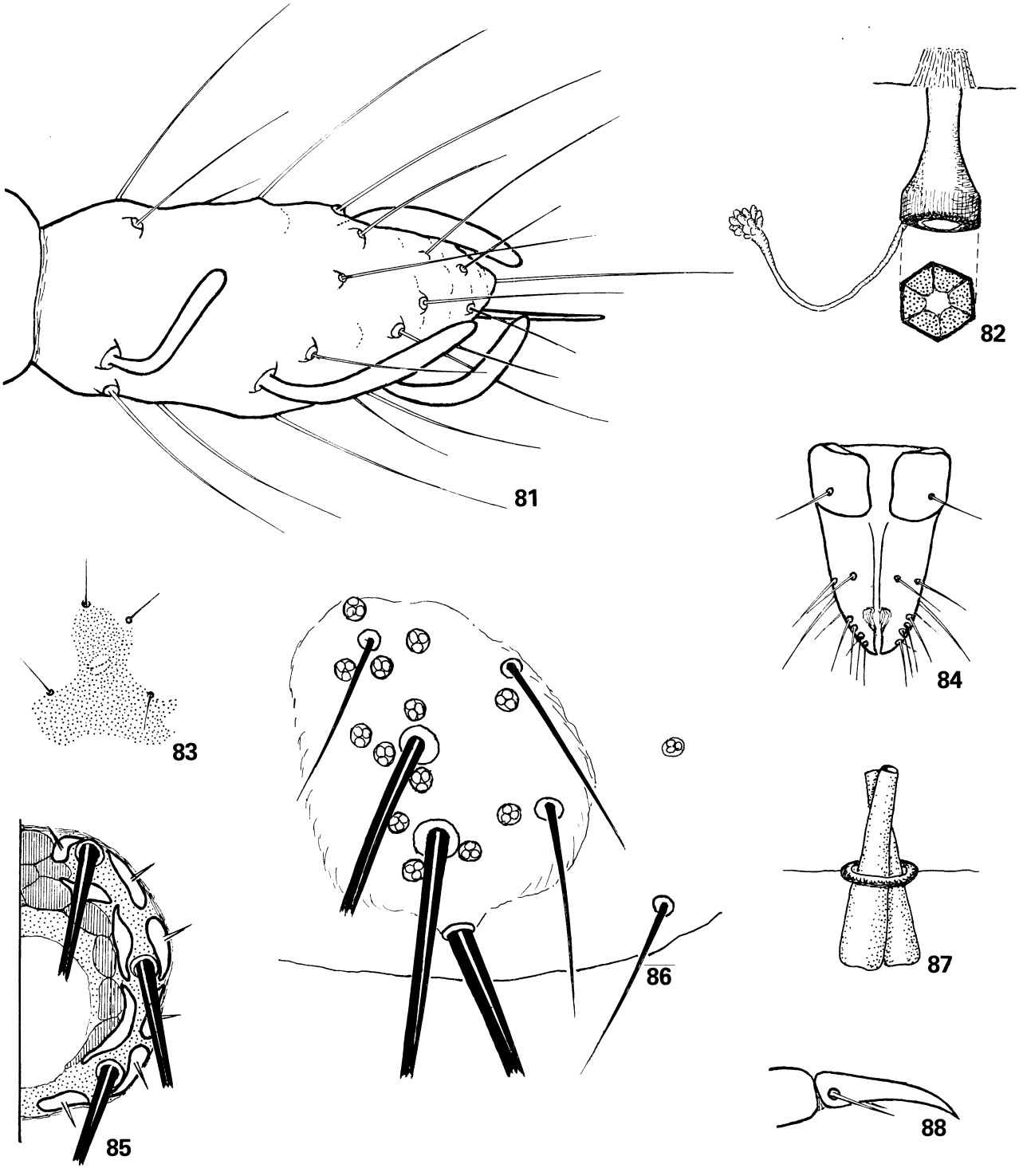
FIGURES 40–54.—*Rhizoecus bicirculus:* 40, Anal ring, right half; 41, cephalic plate; 42, terminal segments of antenna; 43, circulus, dorsal; 44, hind claw; 45, rostrum. *R. bituberculatus:* 46, Bitubular ceroris, lateral; 47, anal ring, right half; 48, terminal segments of antenna; 49, rostrum; 50, cephalic plate; 51, tubular duct, lateral; 52, multilocular disk pore; 53, circulus, dorsolateral; 54, hind claw.



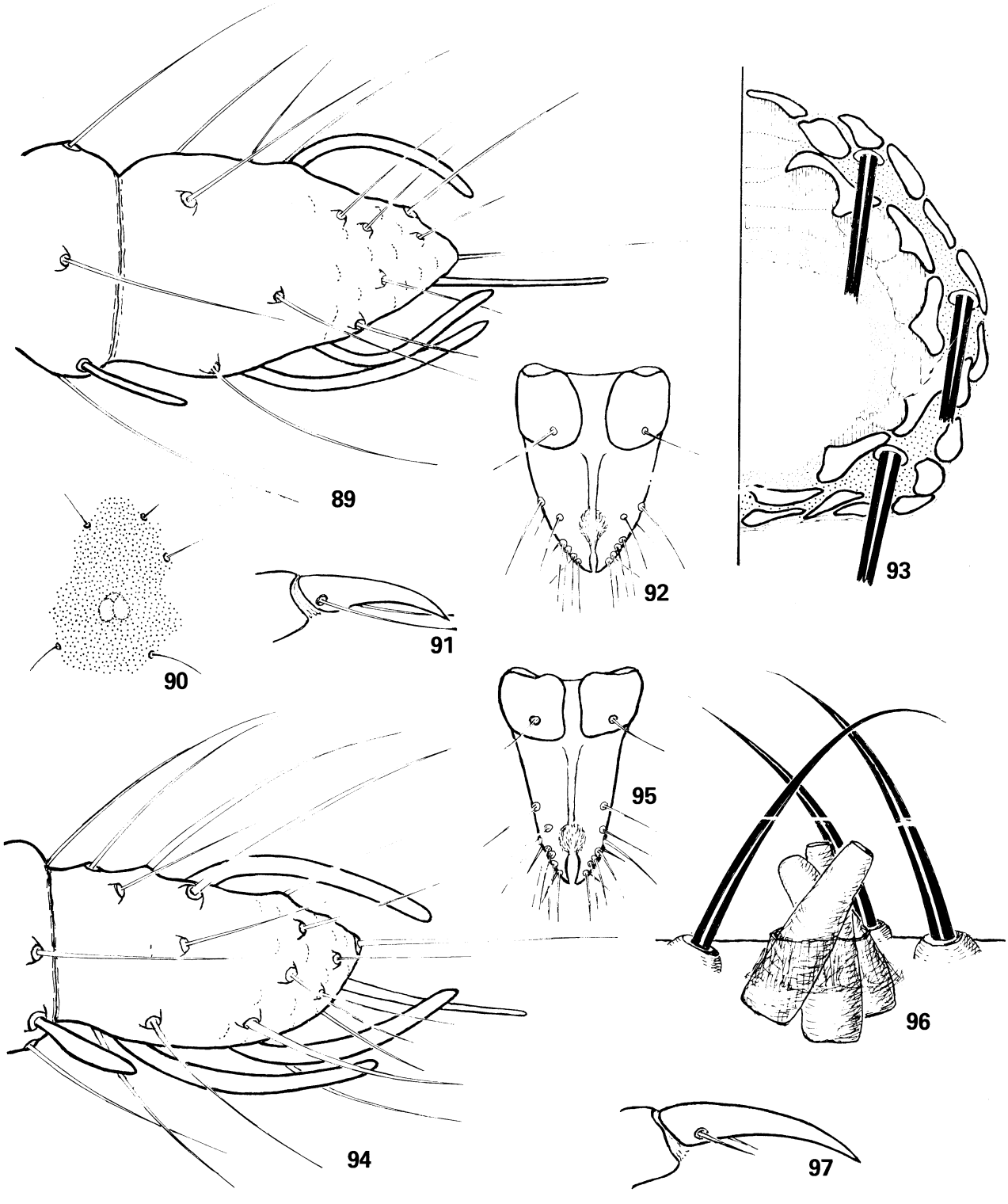
FIGURES 55–65.—*Rhizoecus boharti:* 55, Terminal segments of antenna; 56, cephalic plate; 57, anal ring, right half; 58, hind claw; 59, tubular duct, lateral; 60, rostrum; 61, bitubular ceroris, lateral. *R. cacticans:* 62, Terminal segments of antenna; 63, hind claw; 64, cephalic plate; 65, anal ring, right half.



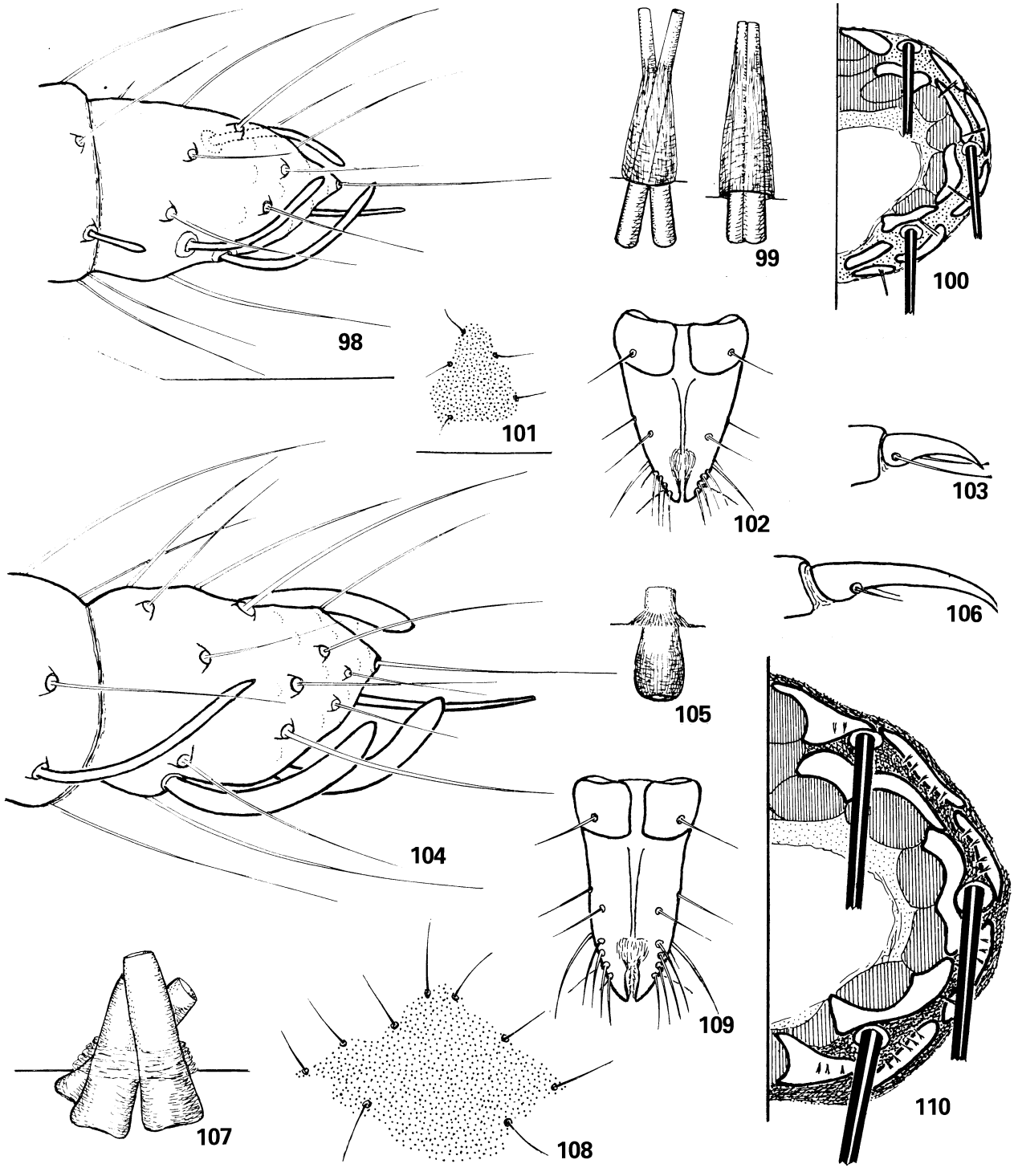
FIGURES 66–80.—*Rhizoecus cacticans:* 66, Rostrum; 67, circulus, lateral; 68, tubular duct, lateral; 69, tritubular ceroris, lateral. *R. caladii:* 70, Hind claw; 71, rostrum. *R. californicus:* 72, Trilocular pore; 73, terminal segments of antenna; 74, tubular duct, lateral; 75, anal ring, right half; 76, cephalic plate; 77, tritubular ceroris, lateral; 78, hind claw; 79, rostrum; 80, circulus, lateral.



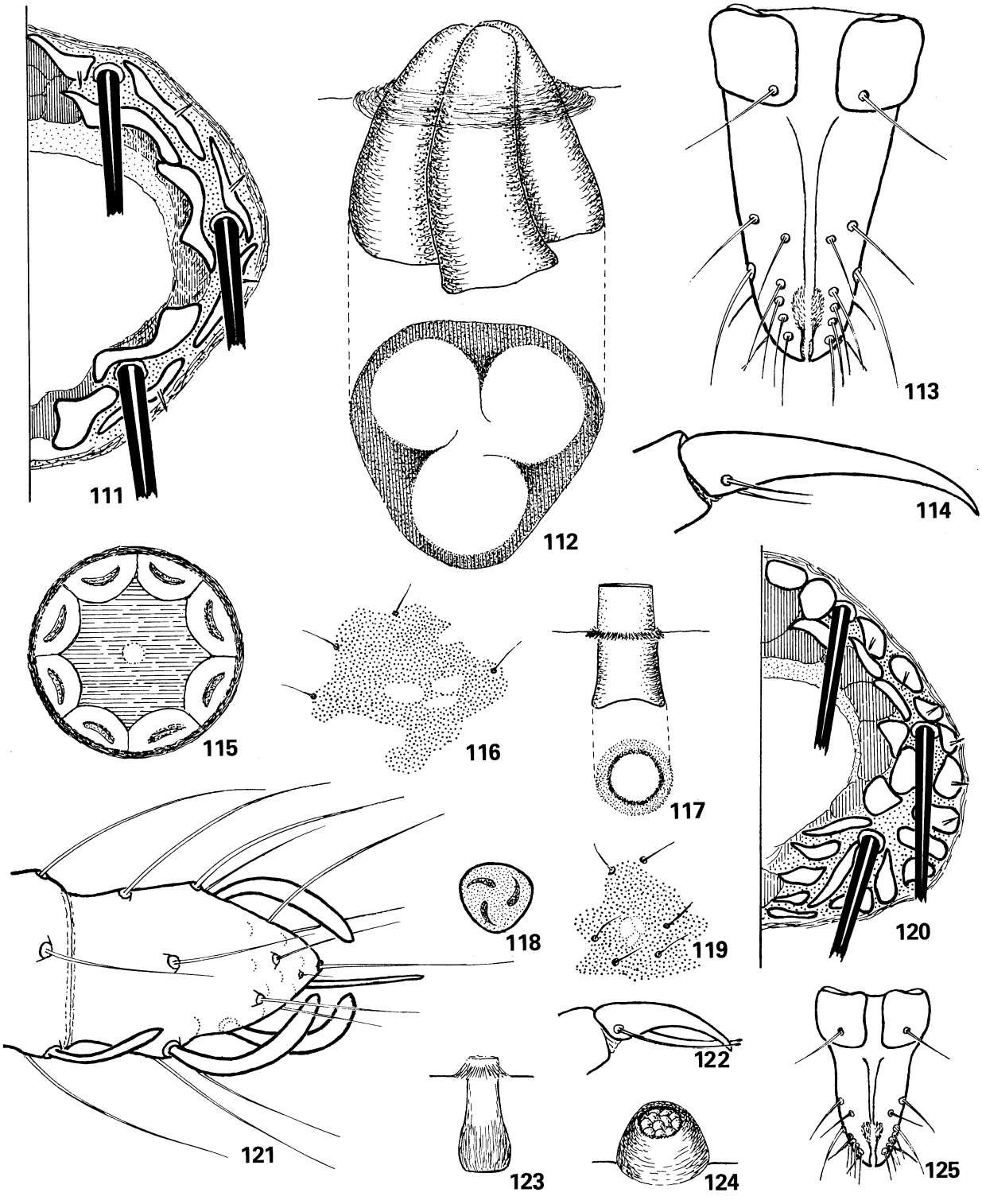
FIGURES 81–88.—*Rhizoecus campestris:* 81, Terminal segments of antenna; 82, tubular duct, lateral and ventral; 83, cephalic plate; 84, rostrum; 85, anal ring, right half; 86, anal lobe, right; 87, bitubular ceroris, lateral; 88, hind claw.



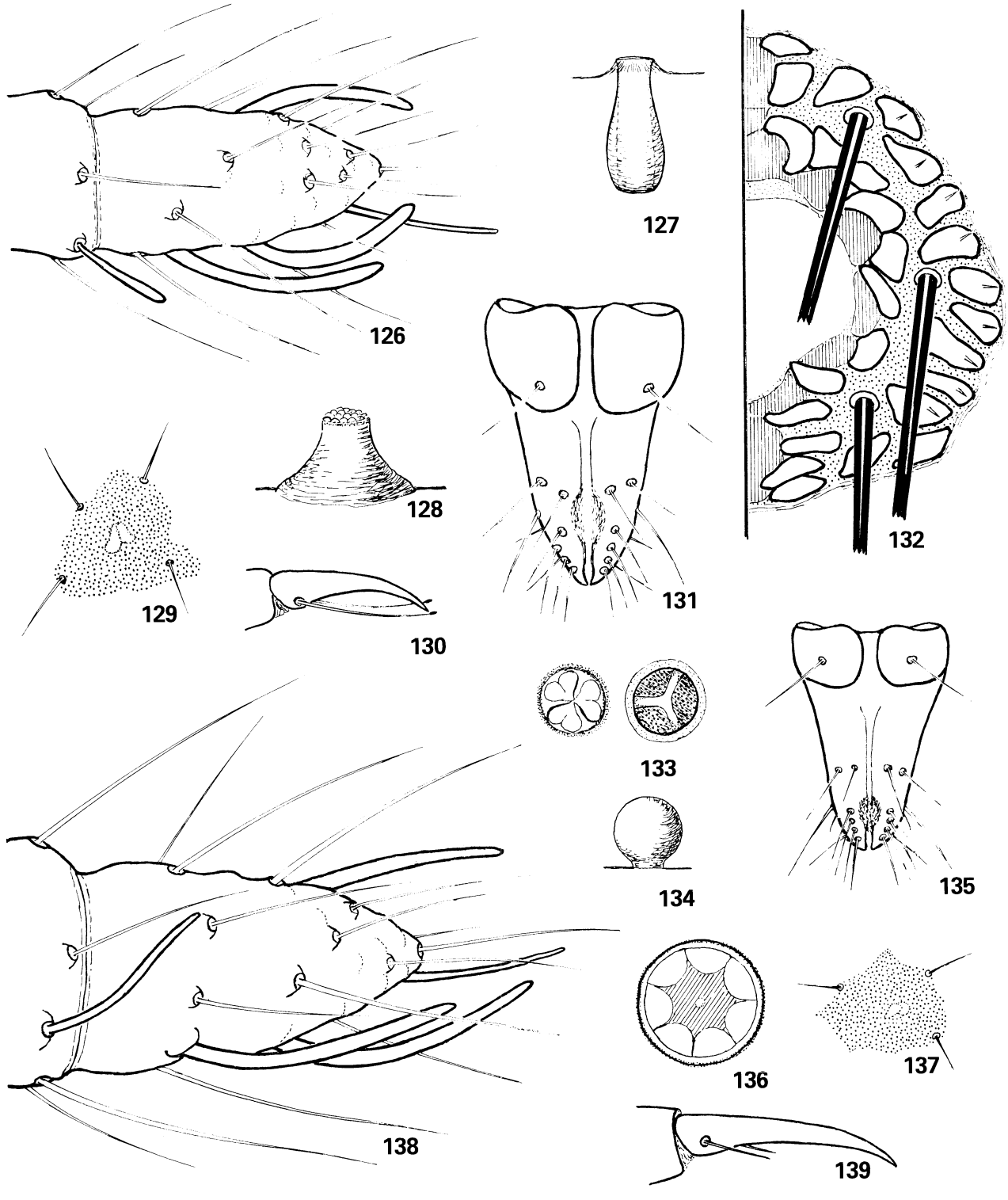
FIGURES 89–97.—*Rhizoecus chilensis*, new species: 89, Terminal segments of antenna; 90, cephalic plate; 91, hind claw; 92, rostrum; 93, anal ring, right half. *R. cyperalis:* 94, Terminal segments of antenna; 95, rostrum; 96, tritubular ceroris and body setae, lateral; 97, hind claw.



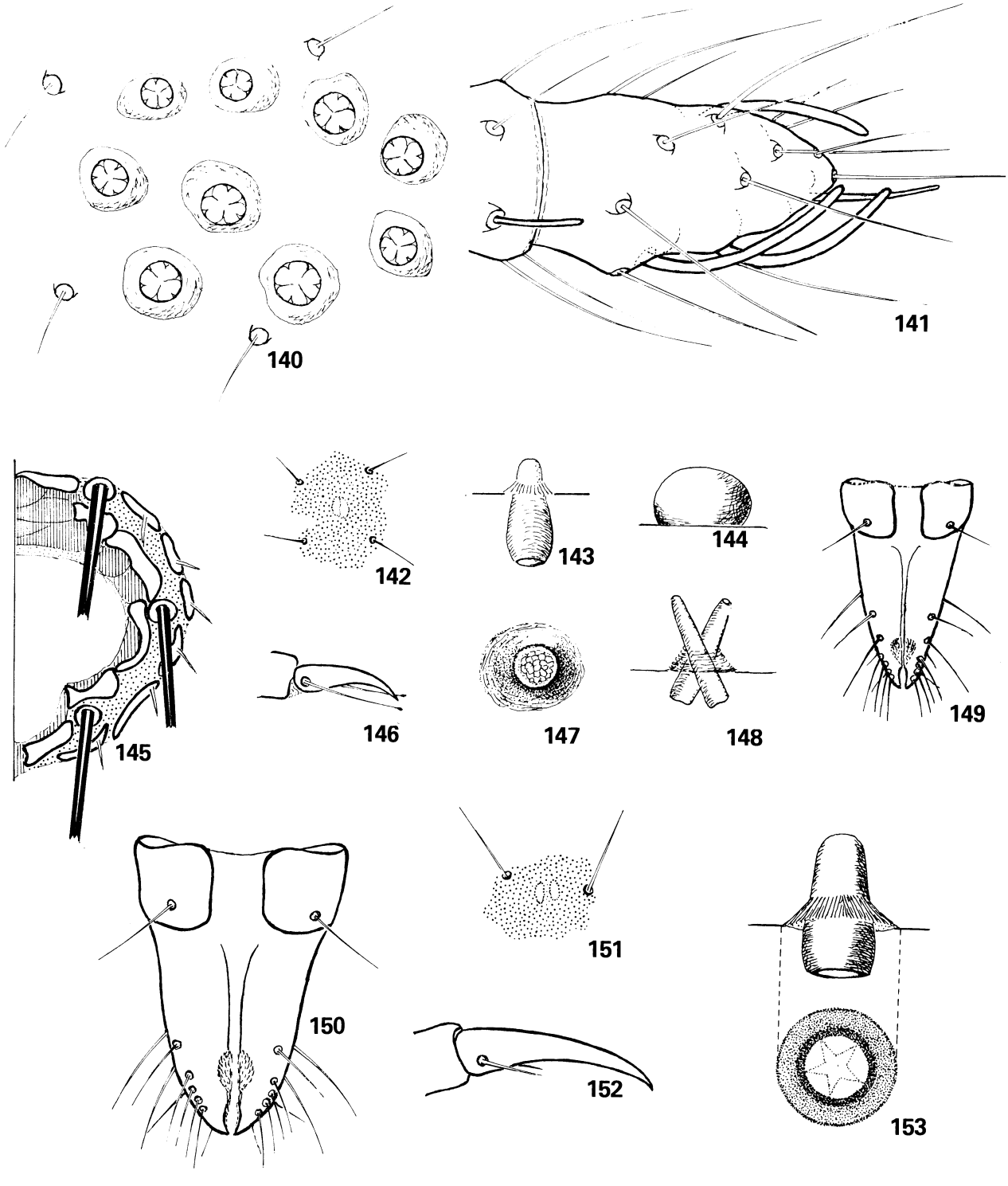
FIGURES 98–110.—*Rhizoecus disjunctus:* 98, Terminal segments of antenna; 99, bitubular cerores, lateral; 100, anal ring, right half; 101, cephalic plate; 102, rostrum; 103, hind claw. *R. distinctus:* 104, Terminal segments of antenna; 105, tubular duct, lateral; 106, hind claw; 107, tritubular ceroris, lateral; 108, cephalic plate; 109, rostrum; 110, anal ring, right half.



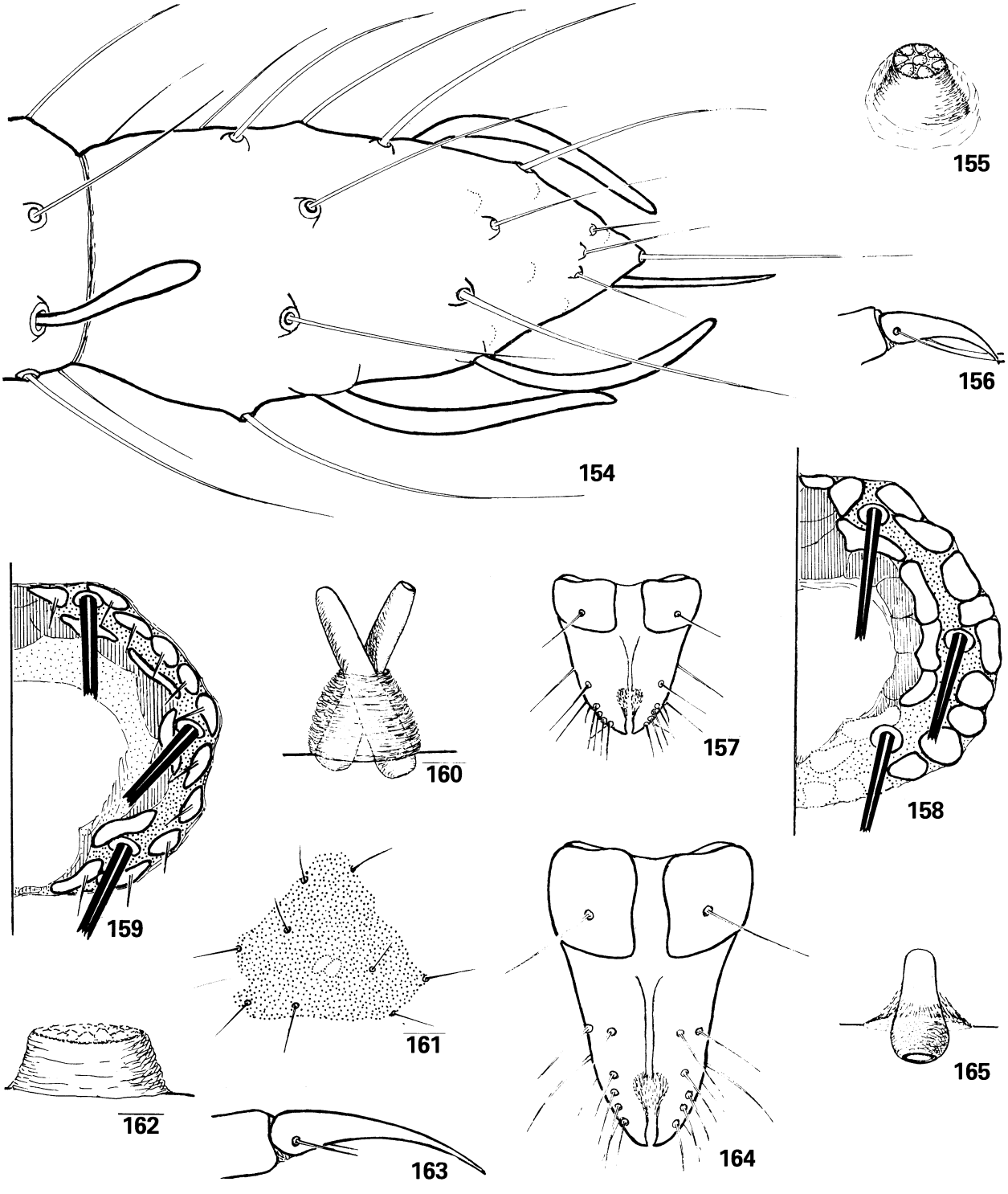
FIGURES 111–125.—*Rhizoecus falcifer:* 111, Anal ring, right half; 112, tritubular ceroris, lateral and ventral; 113, rostrum; 114, hind claw; 115, multilocular disk pore; 116, cephalic plate; 117, tubular duct, lateral and ventral. *R. favacirculus*, new species: 118, Trilocular pore; 119, cephalic plate; 120, anal ring, right half; 121, terminal segments of antenna; 122, hind claw; 123, tubular duct, lateral; 124, circulus, dorsolateral; 125, rostrum.



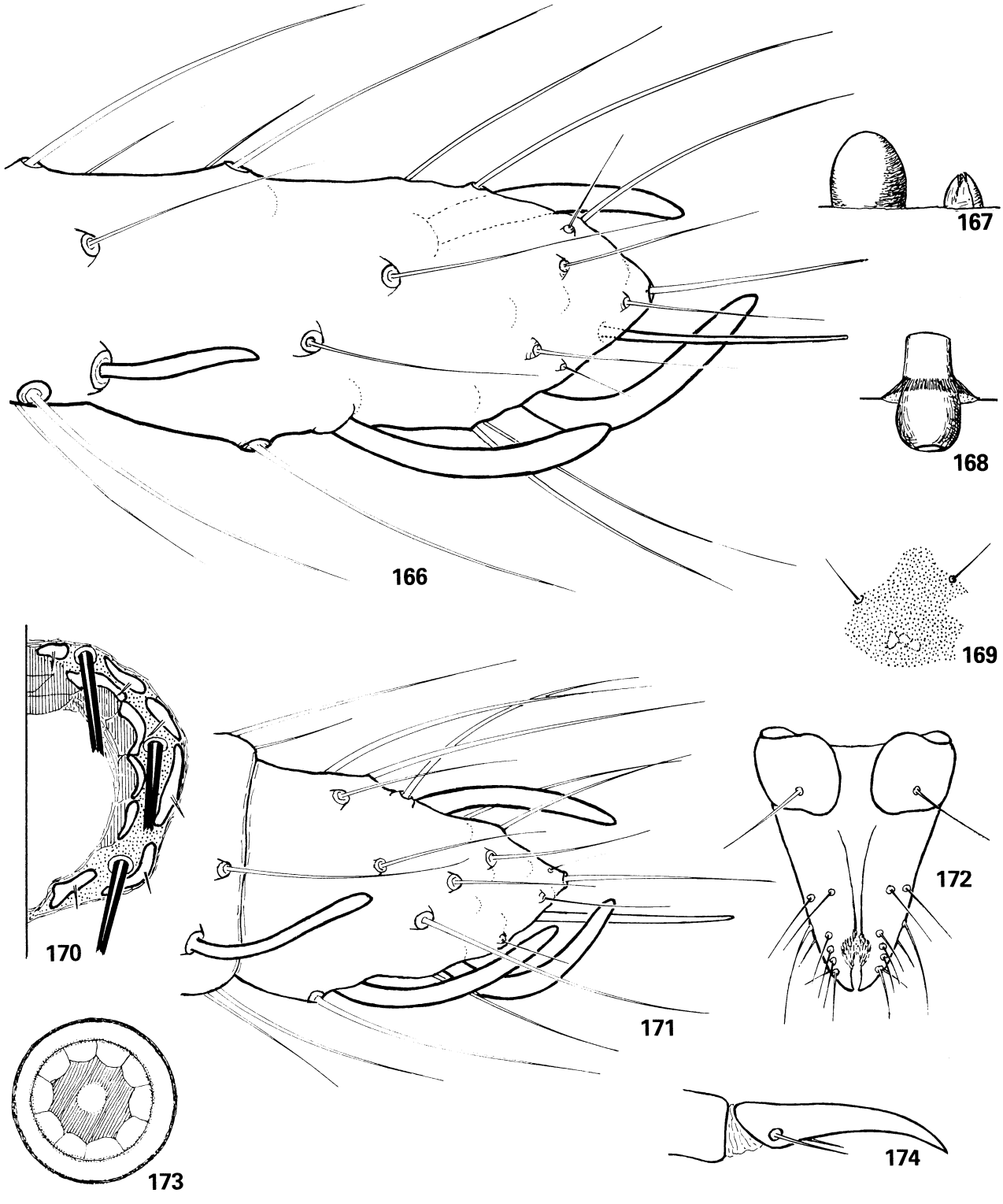
FIGURES 126–139.—*Rhizoecus floridanus:* 126, Terminal segments of antenna; 127, tubular duct, lateral; 128, circulus, lateral; 129, cephalic plate; 130, hind claw; 131, rostrum; 132, anal ring, right half. *R. globoculus:* 133, Medioventral pores, ventral and dorsal; 134, eye, lateral; 135, rostrum; 136, multilocular disk pore; 137, cephalic plate; 138, terminal segments of antenna; 139, hind claw.



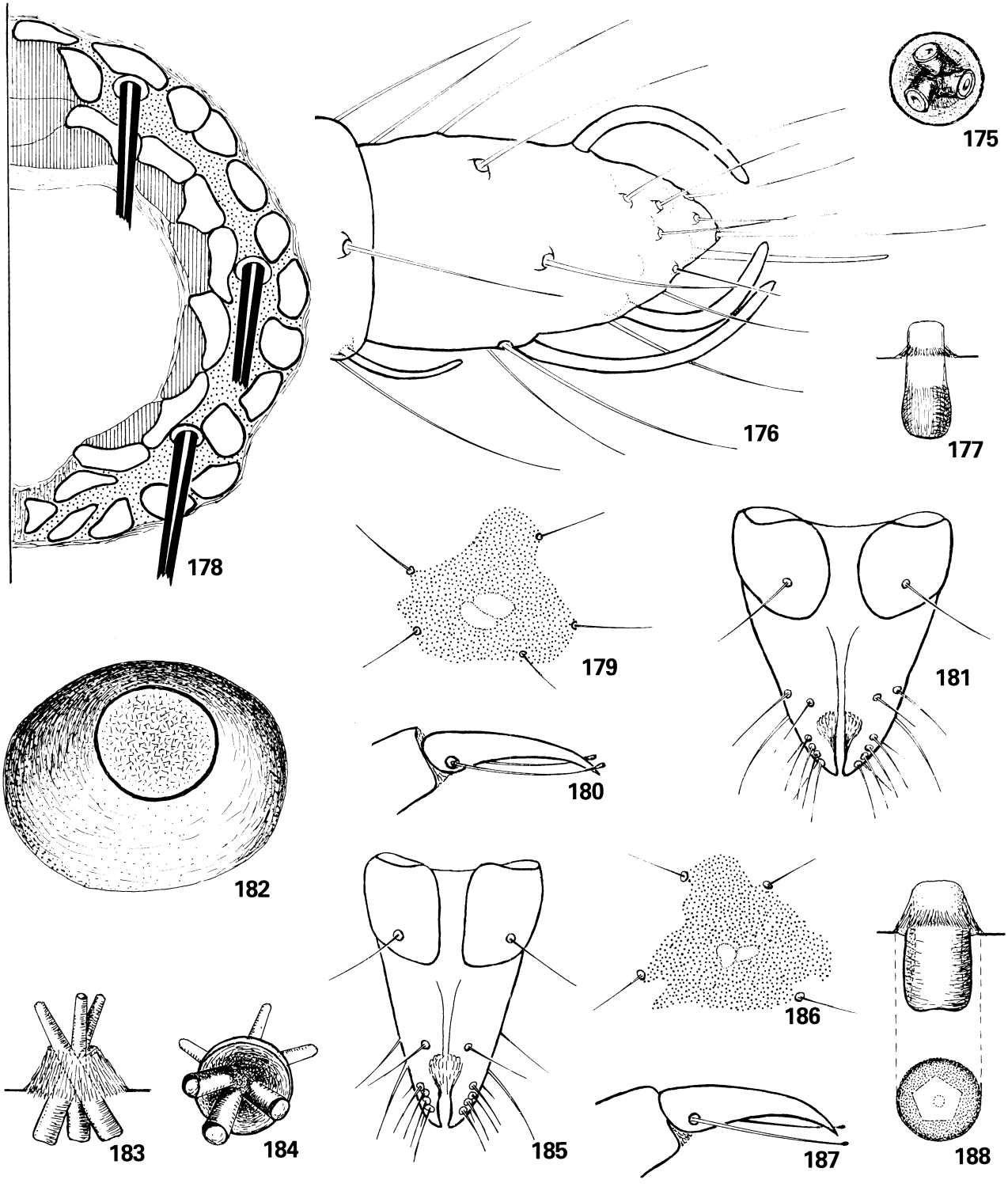
FIGURES 140–153.—*Rhizoecus globoculus:* 140, Cluster of medioventral pores. *R. gracilis:* 141, Terminal segments of antenna; 142, cephalic plate; 143, tubular duct, lateral; 144, eye, lateral; 145, anal ring, right half; 146, hind claw; 147, circulus, dorsal; 148, bitubular ceroris, lateral; 149, rostrum. *R. graminis:* 150, Rostrum; 151, cephalic plate; 152, hind claw; 153, tubular duct, lateral and ventral.



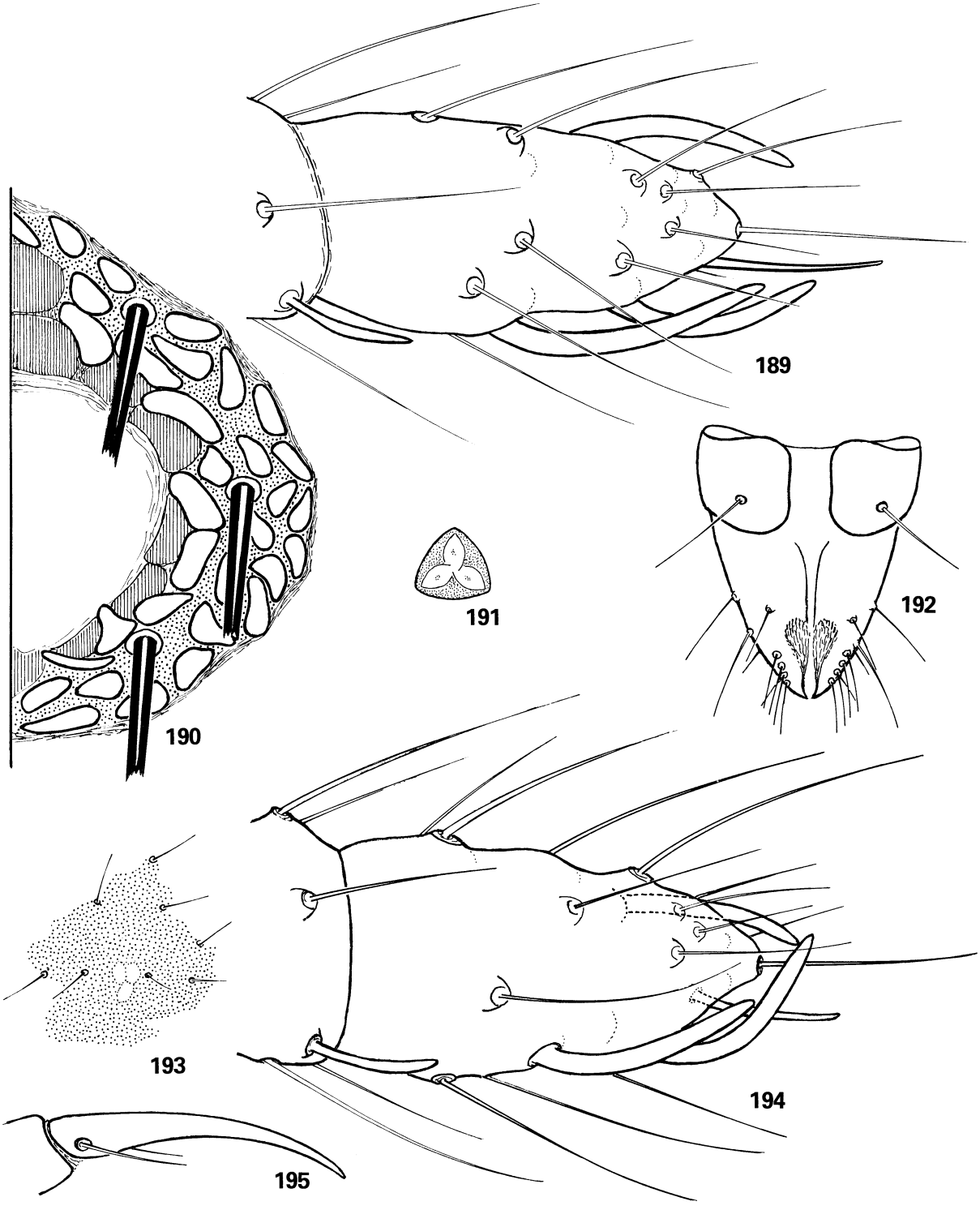
FIGURES 154–165.—*Rhizoecus graminis:* 154, Terminal segments of antenna. *R. insularis,* new species: 155, Circulus, dorsolateral; 156, hind claw; 157, rostrum; 158, anal ring, right half. *R. kondonis:* 159, Anal ring, right half; 160, bitubular ceroris, lateral; 161, cephalic plate; 162, circulus, lateral; 163, hind claw; 164, rostrum; 165, tubular duct, lateral.



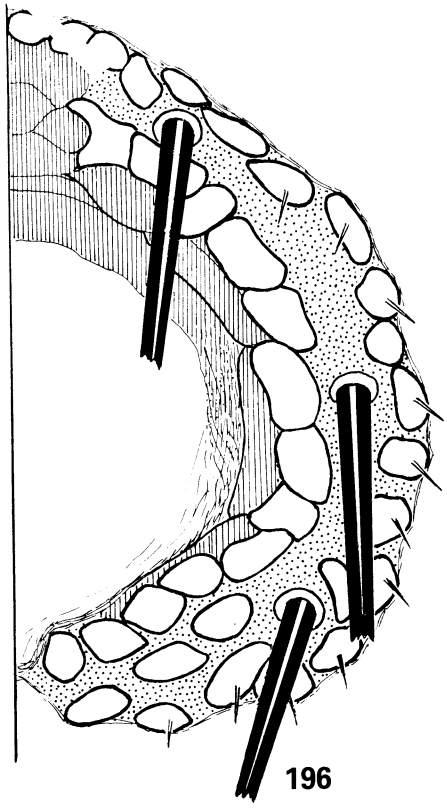
FIGURES 166–174.—*Rhizoecus kondonis:* 166, Terminal segment of antenna. *R. latus:* 167, Eye, left, and tribocular pore, lateral; 168, tubular duct, lateral; 169, cephalic plate; 170, anal ring, right half; 171, terminal segments of antenna; 172, rostrum; 173, multilocular disk pore; 174, hind claw.

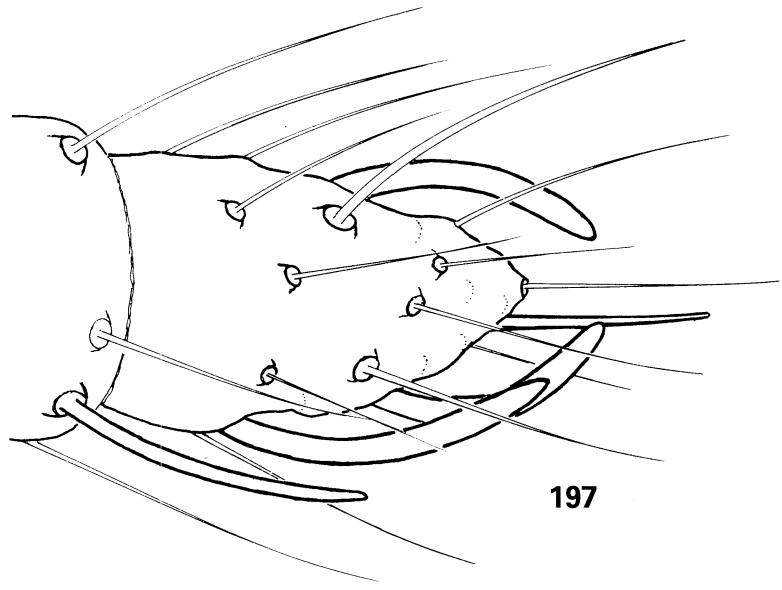


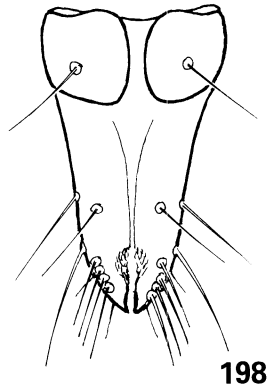
FIGURES 175–188.—*Rhizoecus leucosomus:* 175, Tritubular ceroris, ventral; 176, terminal segments of antenna; 177, tubular duct, lateral; 178, anal ring, right half; 179, cephalic plate; 180, hind claw; 181, rostrum. *R. macgregori,* new species: 182, Circulus, dorsal; 183, tritubular ceroris, lateral; 184, tritubular ceroris, ventral; 185, rostrum; 186, cephalic plate; 187, hind claw; 188; tubular duct, lateral and ventral.

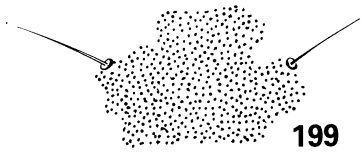


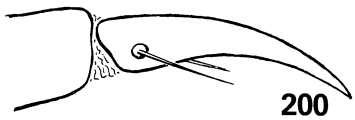
FIGURES 189–195.—*Rhizoecus macgregori*, new species: 189, Terminal segments of antenna; 190, anal ring, right half; 191, trilocular pore. *R. maritimus:* 192, Rostrum; 193, cephalic plate; 194, terminal segments of antenna; 195, hind claw.

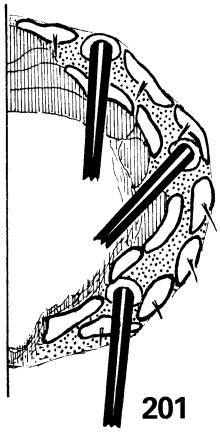


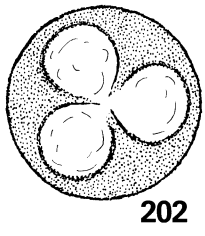


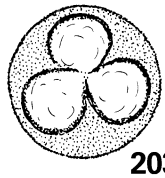


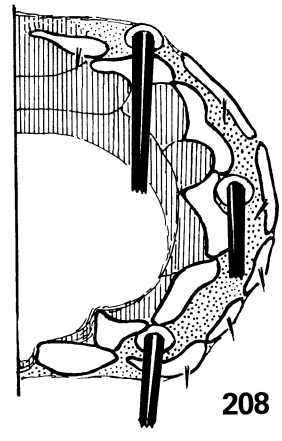


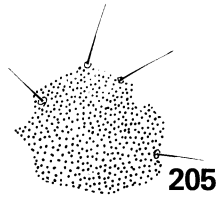


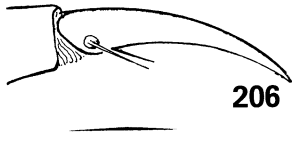




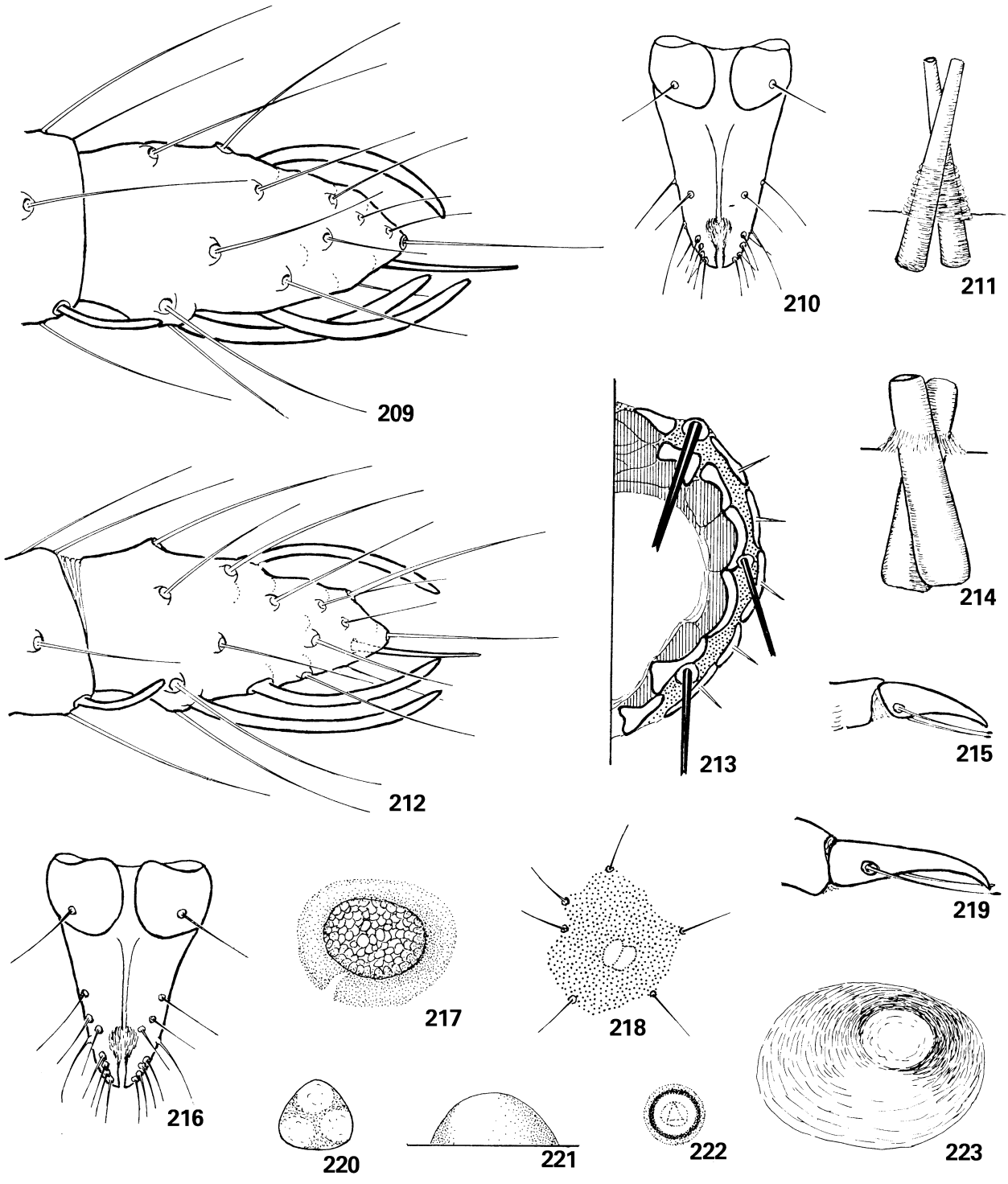




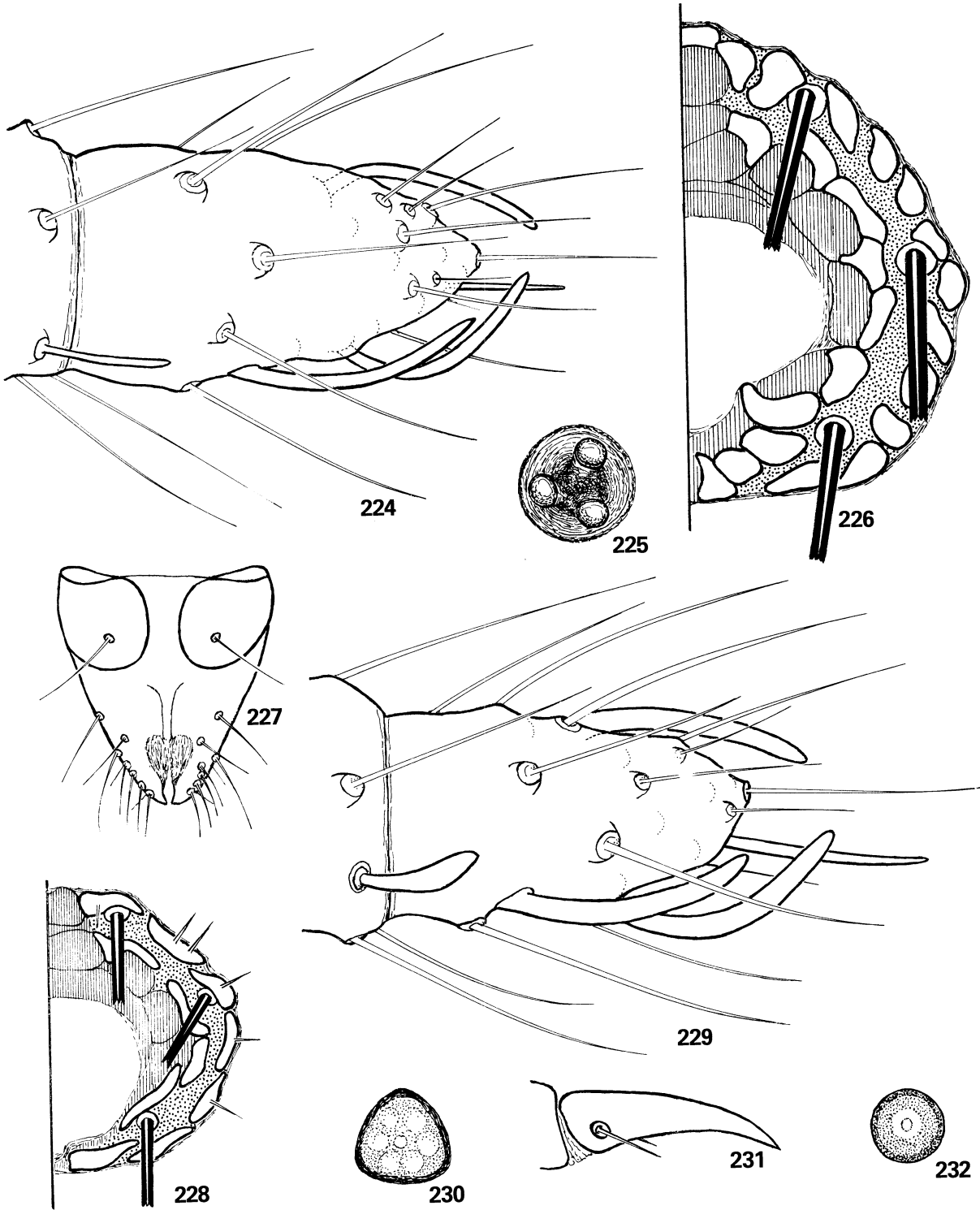




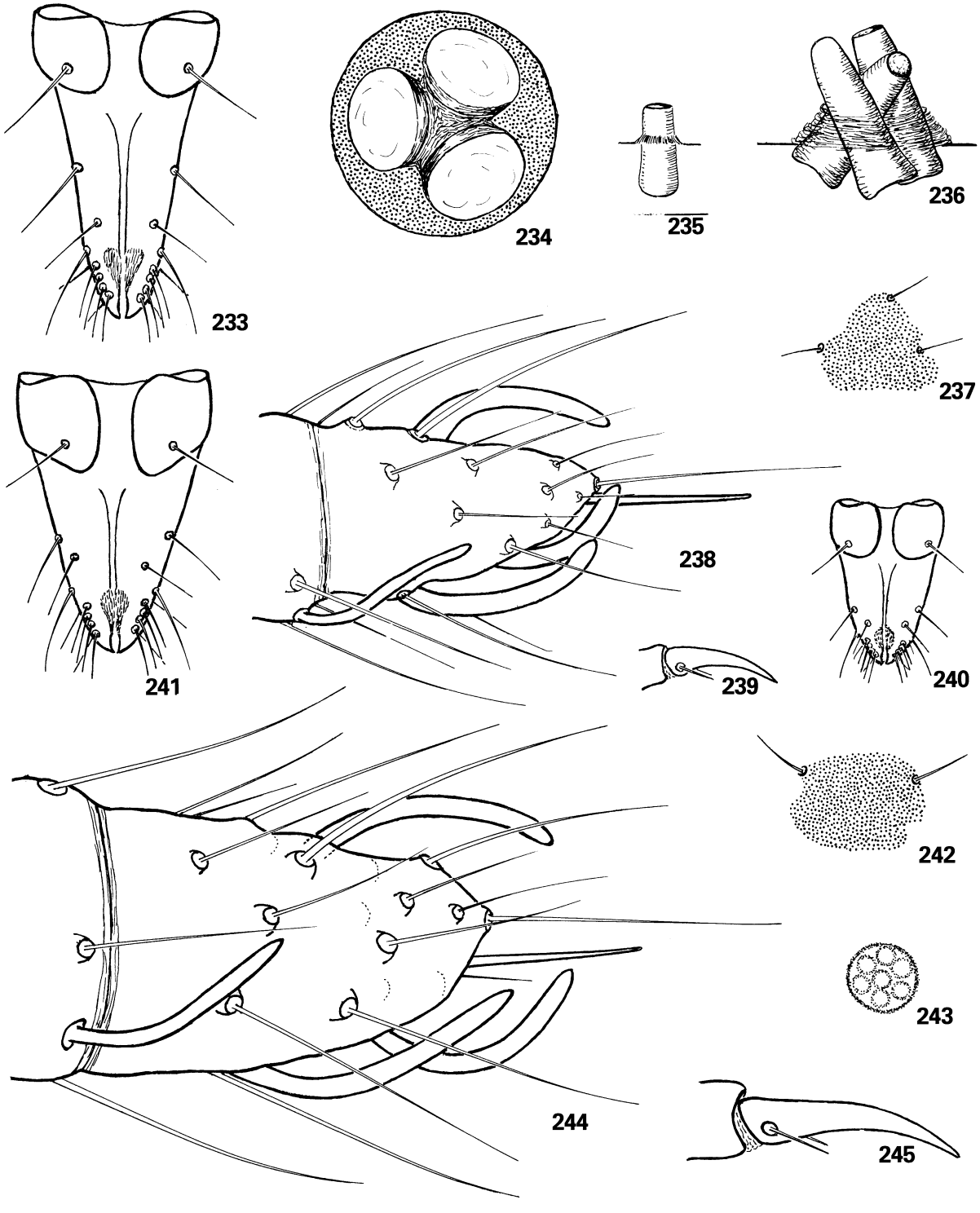
FIGURES 196-208.—*Rhizoecus maritimus:* 196, Anal ring, right half. *R. mayanus:* 197, Terminal segments of antenna; 198, rostrum; 199, cephalic plate; 200, hind claw; 201, anal ring, right half; 202, tritubular ceroris, large, ventral; 203, tritubular ceroris, medium, ventral; 204, tritubular ceroris, small, ventral. *R. menkei:* 205, Cephalic plate; 206, hind claw; 207, circulus, dorsolateral; 208, anal ring, right half.



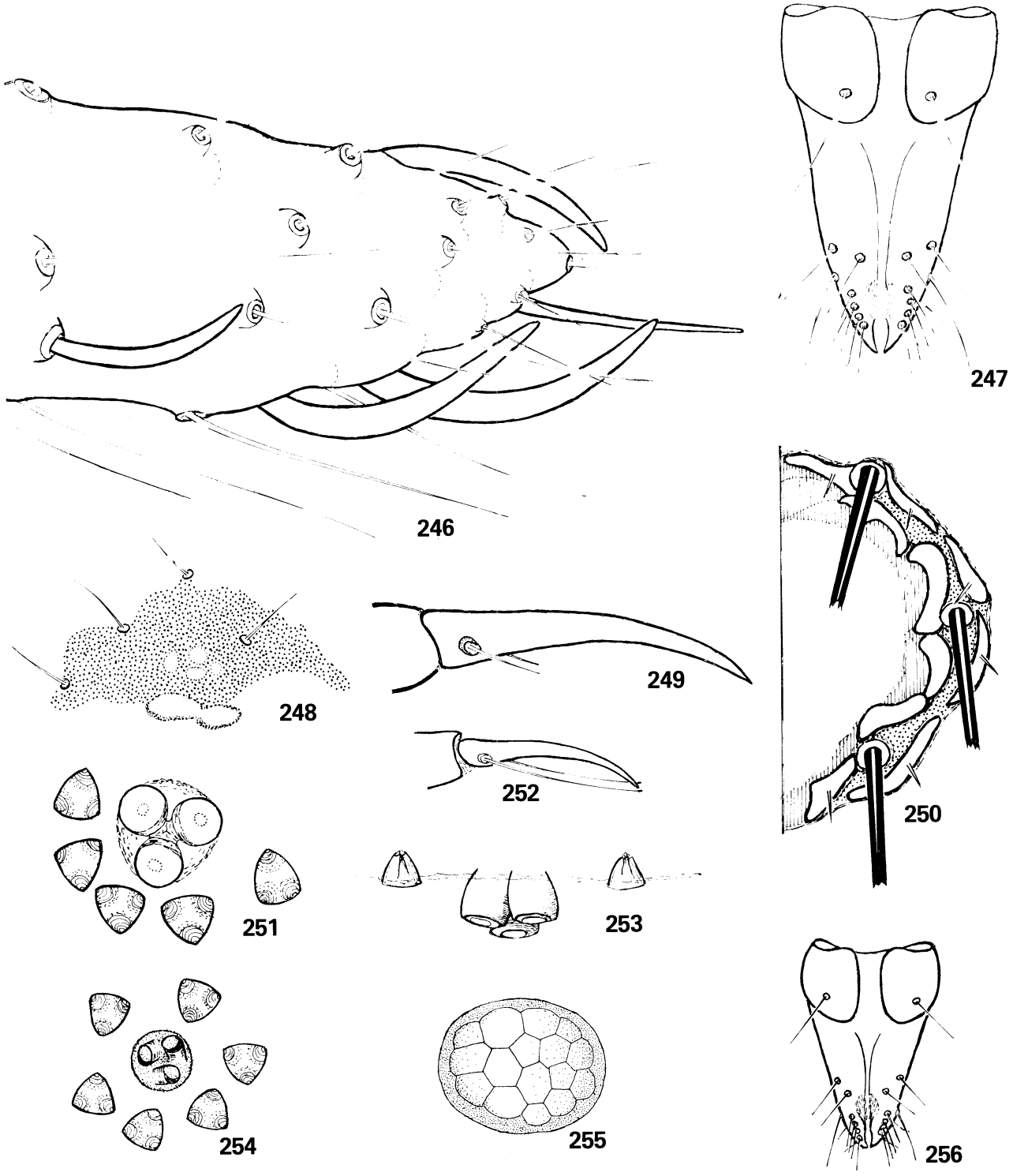
FIGURES 209–223.—*Rhizoecus menkei:* 209, Terminal segments of antenna; 210, rostrum; 211, bitubular ceroris, lateral. *R. mexicanus:* 212, Terminal segments of antenna; 213, anal ring, right half; 214, bitubular ceroris, lateral; 215, hind claw; 216, rostrum; 217, circulus, dorsal. *R. nakaharai,* new species: 218, Cephalic plate; 219, hind claw; 220, trilocular pore; 221, eye, lateral; 222, tubular duct, ventral; 223, circulus, dorsal.



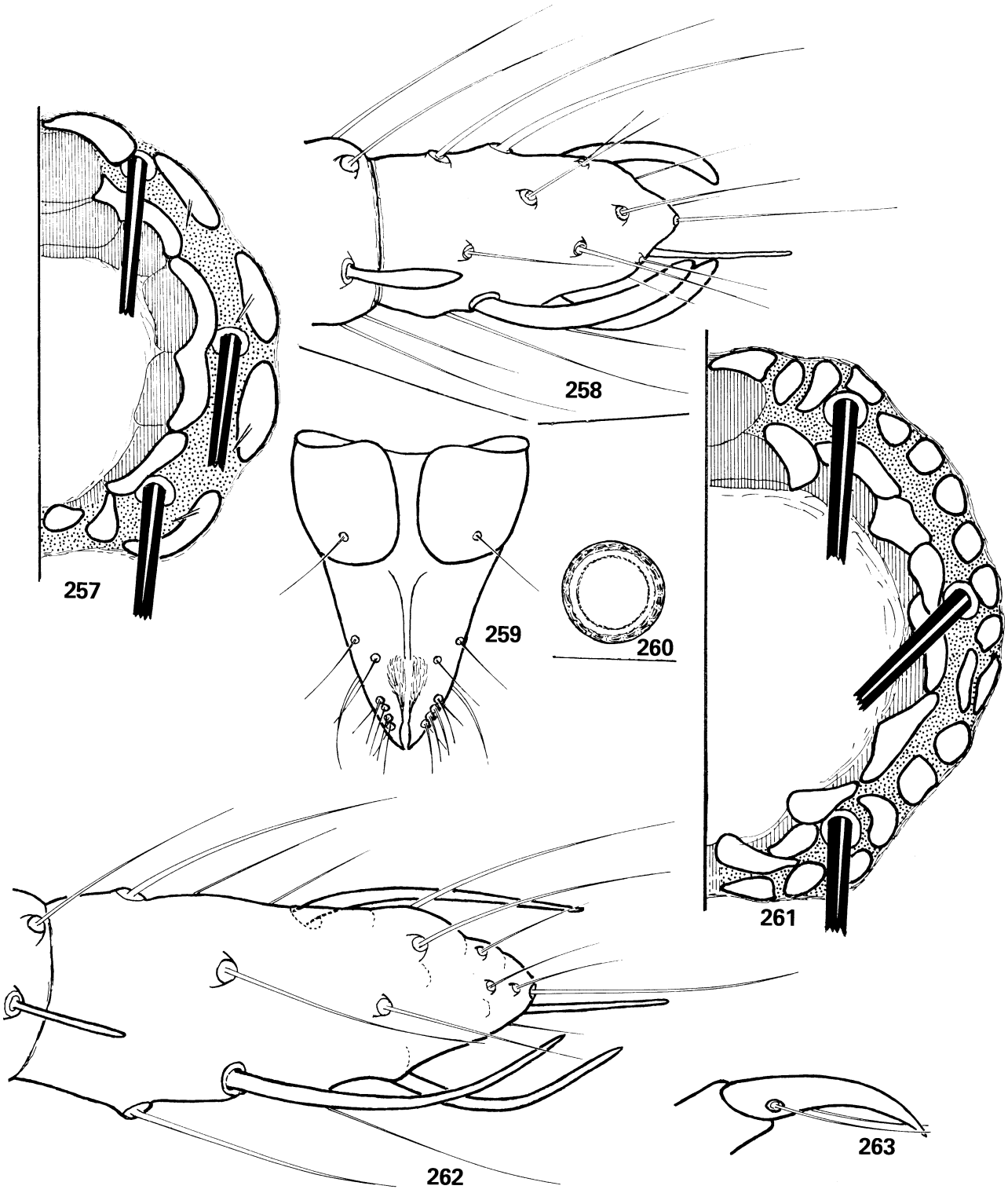
FIGURES 224–232.—*Rhizoecus nakaharai*, new species: 224, Terminal segments of antenna; 225, tritubular ceroris, ventral; 226, anal ring, right half; 227, rostrum. *R. nemoralis:* 228, Anal ring, right half; 229, terminal segments of antenna; 230, trilocular pore; 231, hind claw; 232, tubular duct, ventral.



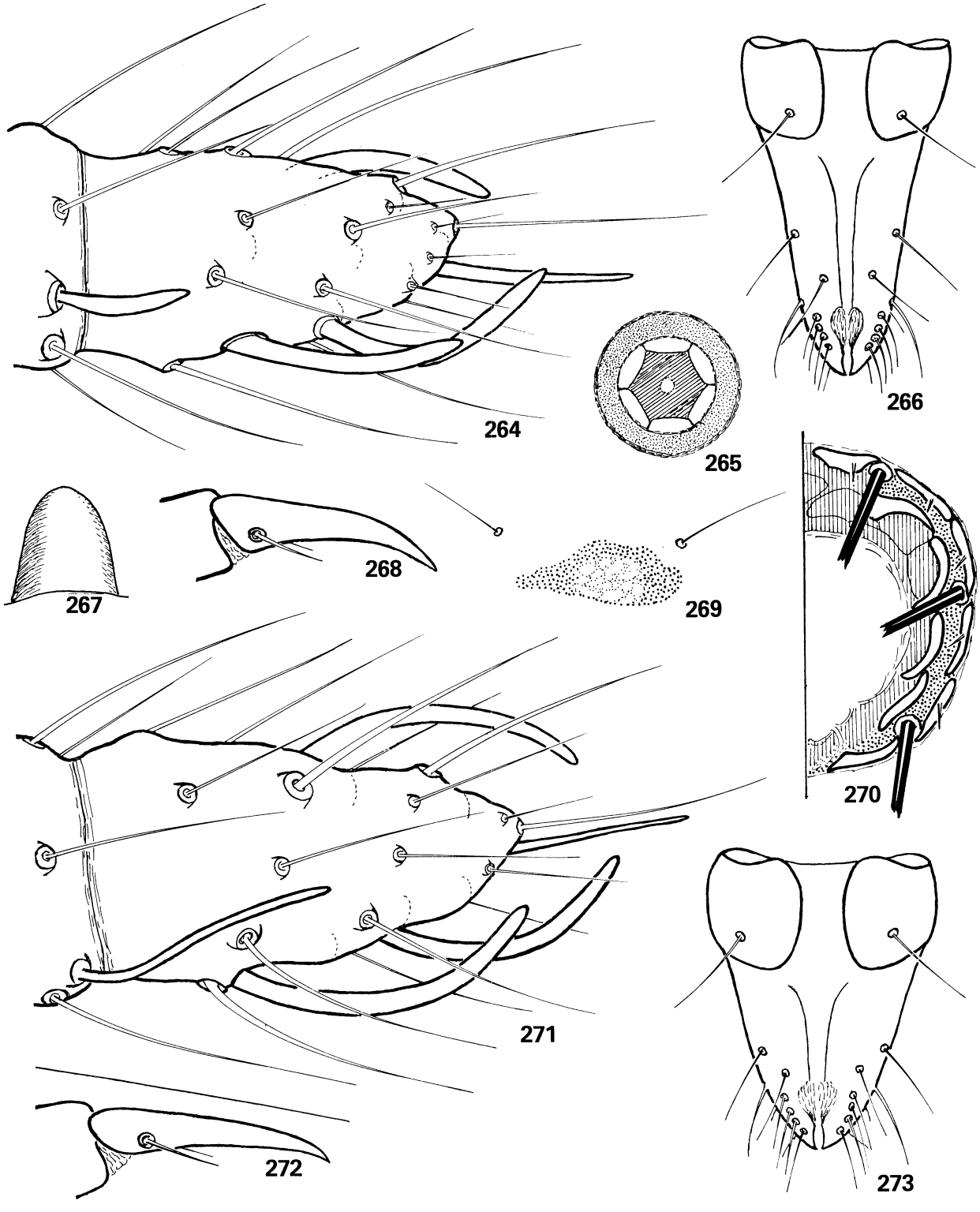
FIGURES 233–245.—*Rhizoecus nemoralis:* 233, Rostrum; 234, tritubular ceroris, ventral. *R. neomexicanus:* 235, Tubular duct, lateral; 236, tritubular ceroris, lateral; 237, cephalic plate; 238, terminal segments of antenna; 239, middle claw; 240, rostrum. *R. neostangei:* 241, Rostrum; 242, cephalic plate; 243, trilocular pore; 244, terminal segments of antenna; 245, hind claw.



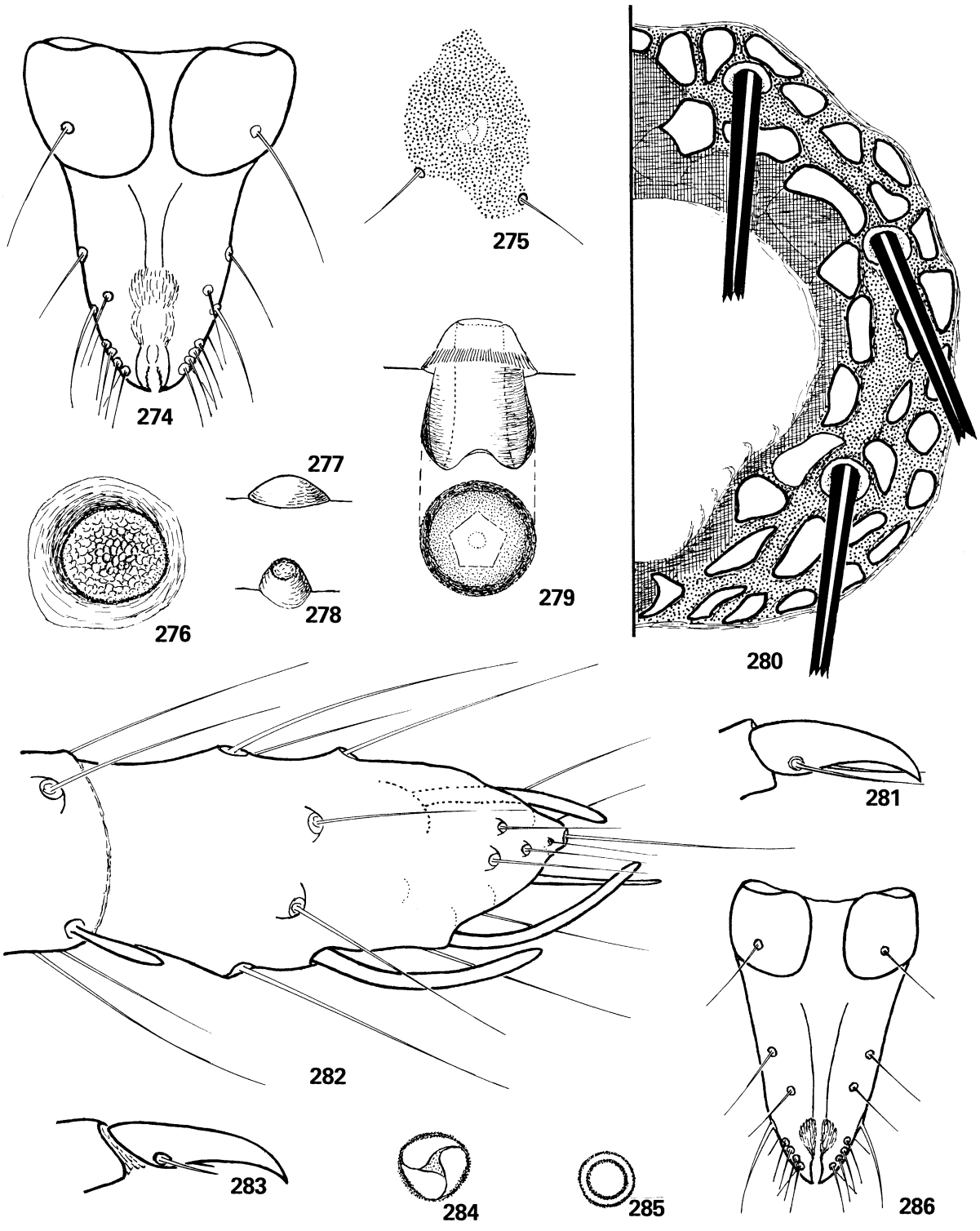
FIGURES 246-256.—*Rhizoecus nitidalis:* 246, Terminal segment of antenna; 247, rostrum; 248, cephalic plate; 249, hind claw; 250, anal ring, right half. *R. ornatus:* 251, Tritubular ceroris and trilocular pores, ventral; 252, hind claw; 253, tritubular ceroris, lateral; 254, small tritubular ceroris and trilocular pores, ventral; 255, circulus, dorsal; 256, rostrum.



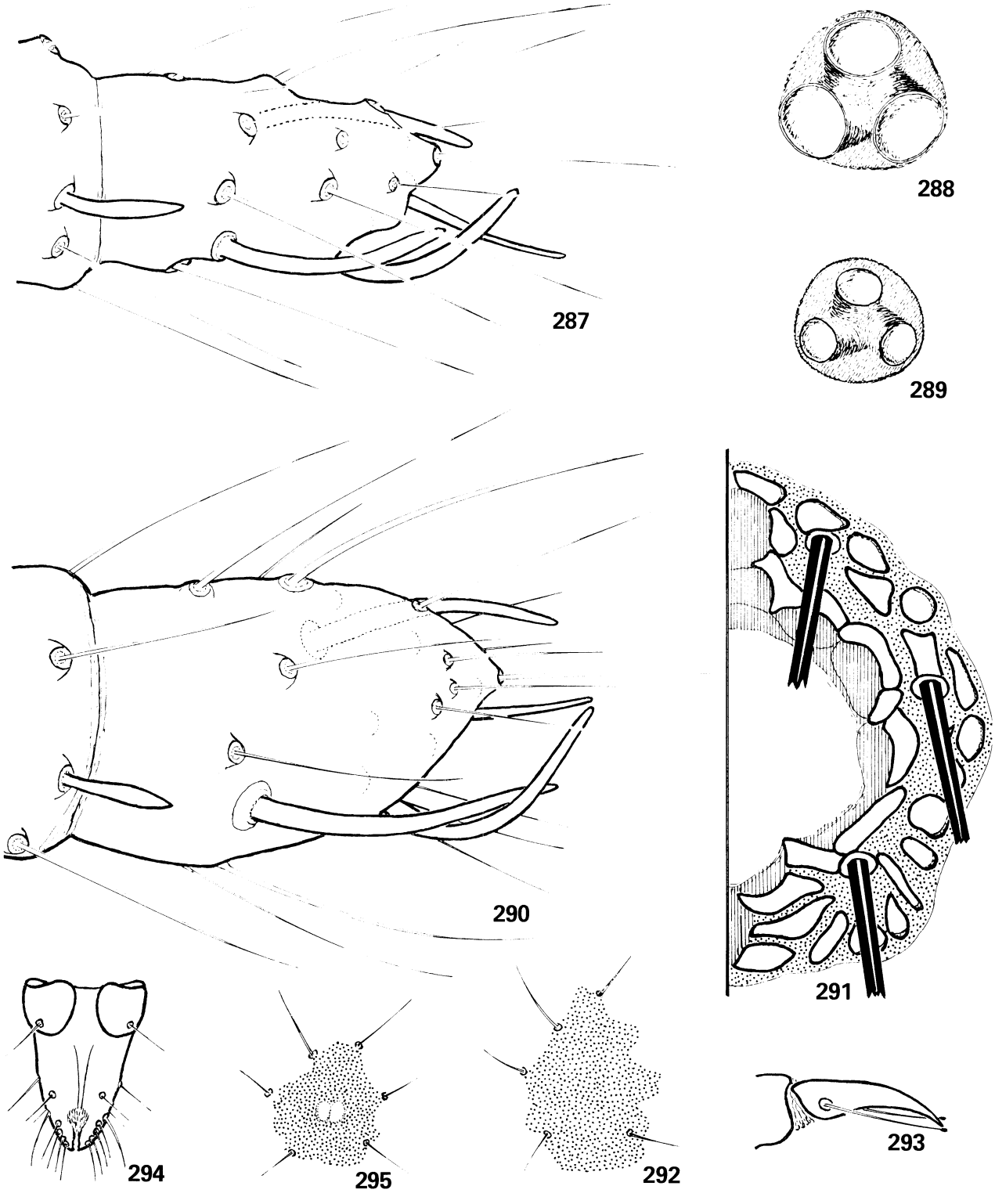
FIGURES 257–263.—*Rhizoecus ornatus:* 257, Anal ring, right half; 258, terminal segments of antenna. *R. ovatus*, new species: 259, Rostrum; 260, tubular duct, ventral; 261, anal ring, right half; 262, terminal segments of antenna; 263, hind claw.



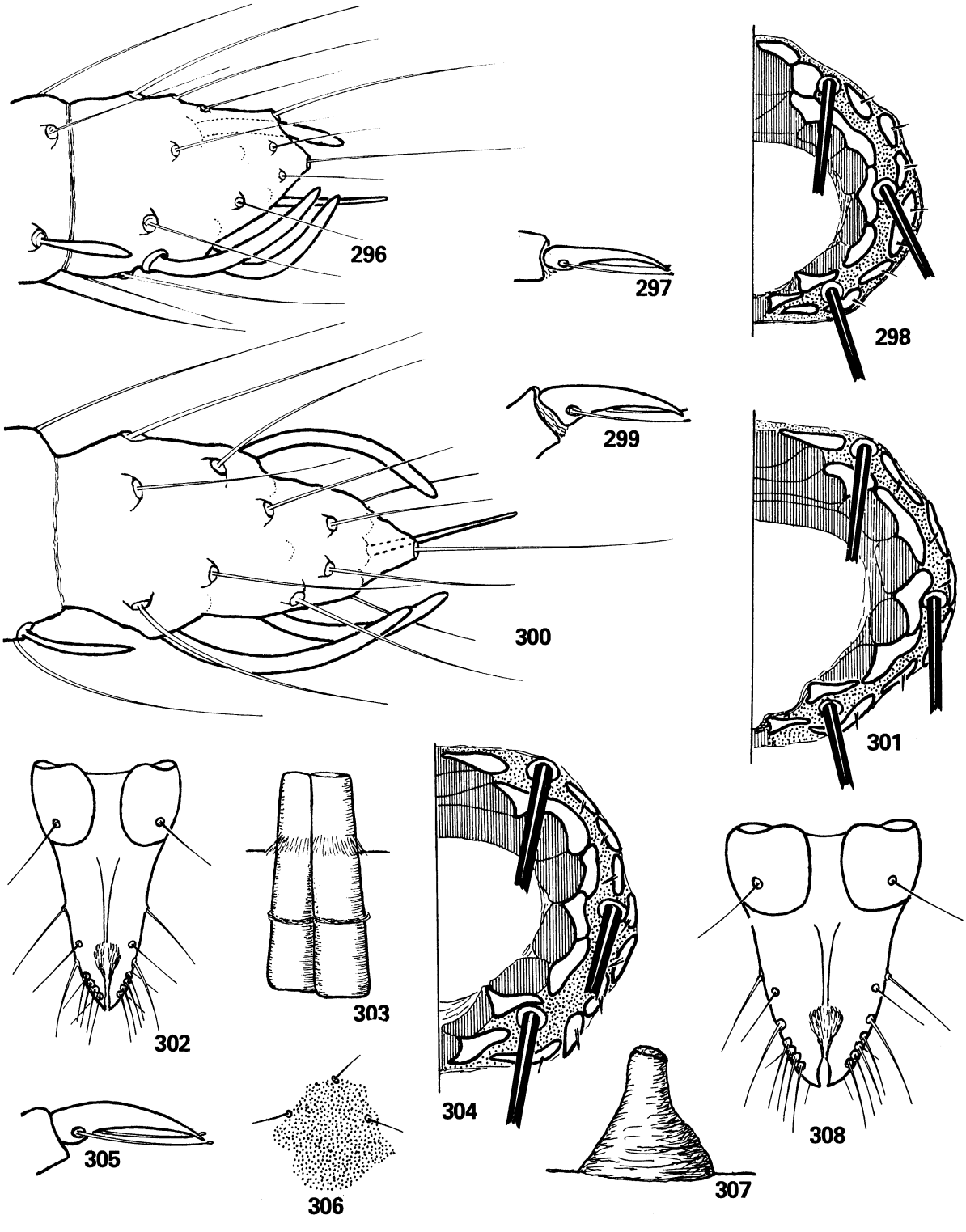
FIGURES 264-273.—*Rhizoecus pauciporus*, new species: 264, Terminal segments of antenna; 265, multilocular disk pore; 266, rostrum; 267, eye, lateral; 268, hind claw. *R. poensis:* 269, Cephalic plate; 270, anal ring, right half; 271, terminal segments of antenna; 272, hind claw; 273, rostrum.



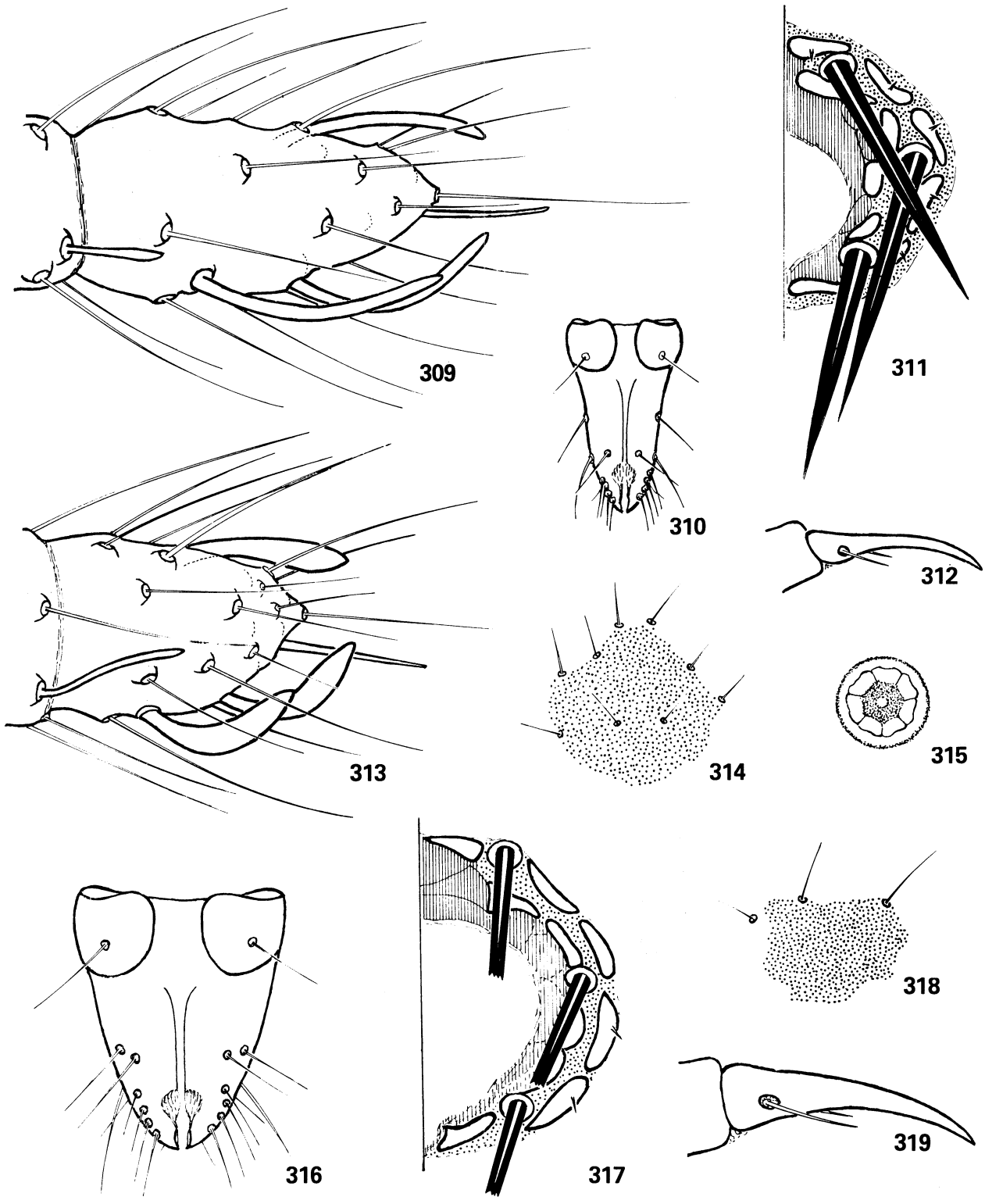
FIGURES 274–286.—*Rhizoecus polyporus*, new species: 274, Rostrum; 275, cephalic plate; 276, circulus, dorsal; 277, eye, lateral; 278, small circulus, dorsolateral; 279, tubular duct, lateral and ventral; 280, anal ring, right half; 281, hind claw; 282, terminal segments of antenna. *R. pritchardi:* 283, Hind claw; 284, trilocular pore; 285, tubular duct, ventral; 286, rostrum.



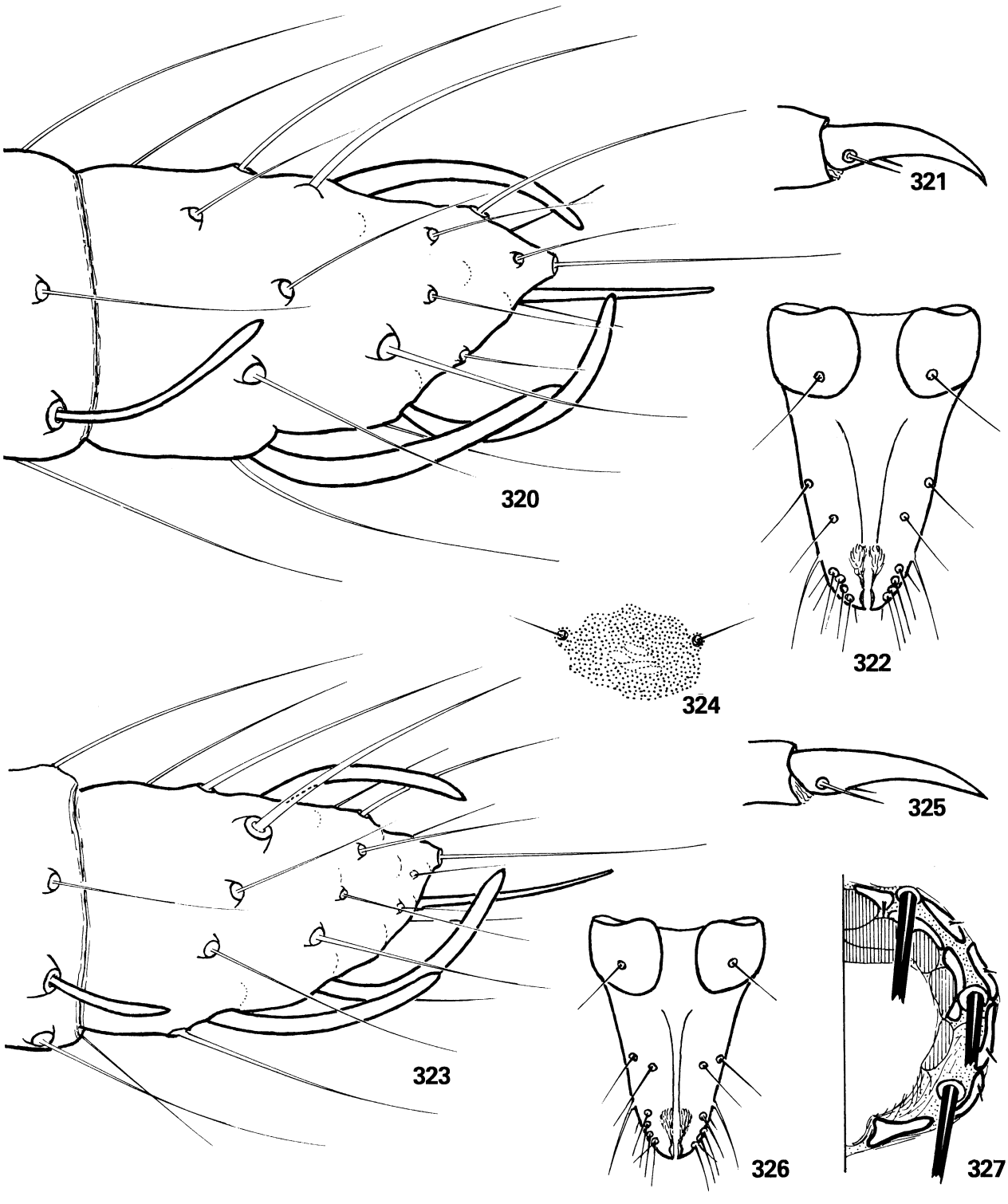
FIGURES 287-295.—*Rhizoecus pritchardi:* 287, Terminal segments of antenna; 288, large tritubular ceroris, ventral; 289, small tritubular ceroris, ventral. *R. relativus,* new species: 290, Terminal segments of antenna; 291, anal ring, right half; 292, cephalic plate; 293, middle claw. *R. simplex:* 294, Rostrum; 295, cephalic plate.



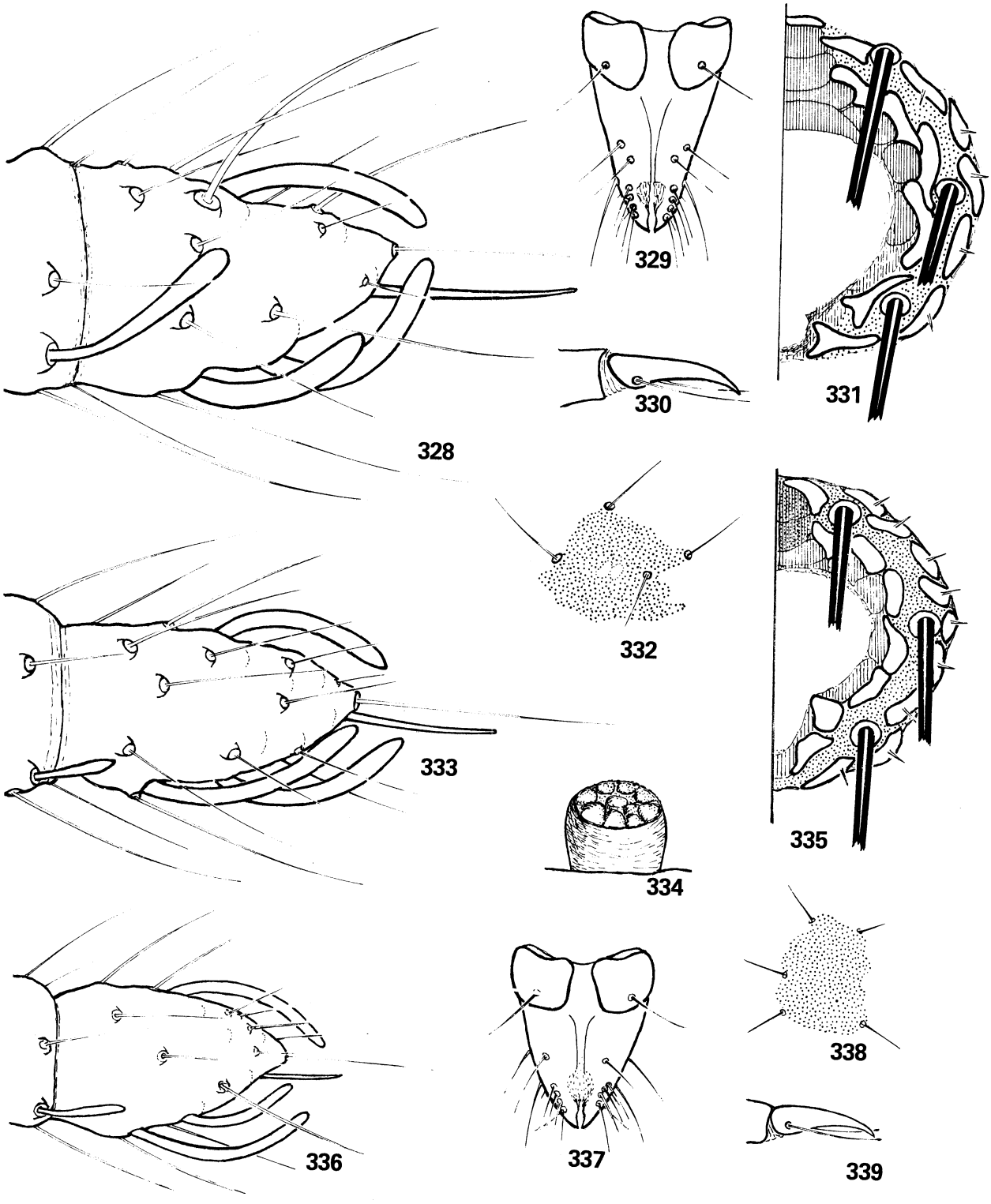
FIGURES 296–308.—*Rhizoecus simplex:* 296, Terminal segments of antenna; 297, hind claw; 298, anal ring, right half. *R. solani:* 299, Hind claw; 300, terminal segments of antenna; 301, anal ring, right half; 302, rostrum; 303, bitubular ceroris, lateral. *R. sonomae:* 304, Anal ring, right half; 305, hind claw; 306, cephalic plate; 307, circulus, lateral; 308, rostrum.



FIGURES 309–319.—*Rhizoecus sonomae:* 309, Terminal segments of antenna. *R. spinipes:* 310, Rostrum; 311, anal ring, right half; 312, hind claw; 313, terminal segments of antenna; 314, cephalic plate; 315, multilocular disk pore. *R. stangei:* 316, Rostrum; 317, anal ring, right half; 318, cephalic plate; 319, hind claw.



FIGURES 320–327.—*Rhizoecus stangei:* 320, Terminal segments of antenna. *R. subcyperalis,* new species: 321, Hind claw; 322, rostrum; 323, terminal segments of antenna. *R. theobromae:* 324, Cephalic plate; 325, hind claw; 326, rostrum; 327, anal ring, right half.



FIGURES 328–339.—*Rhizoecus theobromae*: 328, Terminal segments of antenna. *R. totonicapanus:* 329, Rostrum; 330, hind claw; 331, anal ring, right half; 332, cephalic plate; 333, terminal segments of antenna. *R. tropicalis*, new species: 334, Circulus, dorsolateral; 335, anal ring, right half; 336, terminal segments of antenna; 337, rostrum; 338, cephalic plate; 339, hind claw.

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